LARYNX

INTRODUCTION-

- Larynx is below the hyoid bone and above trachea
- It is made up of cartilages, membranes, mucosa and muscles

Cartilages of larynx

- Larynx is made up of 6 cartilages. There are 3 paired & 3 unpaired Cartilages
- 3 unpaired cartilages
  - Thyroid
  - Cricoid
  - Epiglottis
- 3 Paired cartilages
  - Arytenoids
  - Corniculate
  - Cuneiform

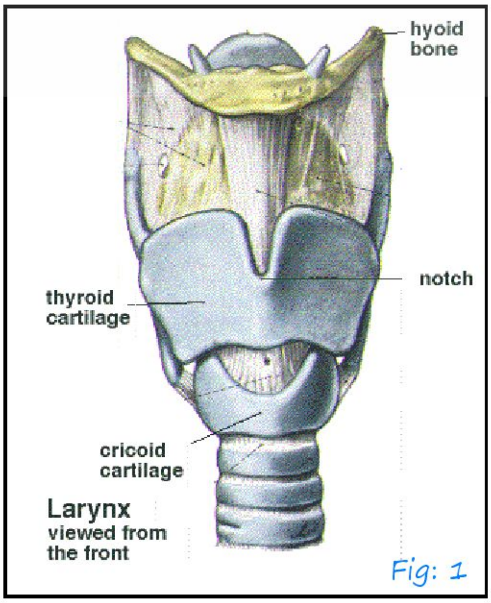

hyoid bone
notch
thyroid cartilage
cricoid cartilage
Larynx viewed from the front

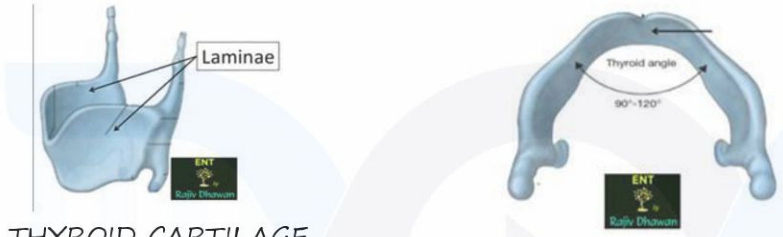
Fig: 1

First, we will learn three topics in anatomy of larynx

1. Cartilages of Larynx
2. Membranes of Larynx
3. Mucosa of Larynx

A. 3 unpaired cartilages

1.THYROID CARTILAGE



THYROID CARTILAGE

THYROID ANGLE Fig: 2

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- Shape of thyroid cartilage is open book like cartilage.
- Thyroid cartilage is open posteriorly
- There are two laminae of thyroid cartilage.
- Thyroid angle – It is the Angle between 2 laminae of thyroid cartilage
- Thyroid angle is different in males and females.

Females	Males
120 degrees	90 degrees
	Prominence of thyroid cartilage in males is called Adam's apple.

2.CRICOID CARTILAGE

- Cricoid is ring like cartilage.
- It has narrow arch anteriorly and Broad lamina posteriorly (towards cervical vertebrae). Cricoid cartilage sits over the trachea.

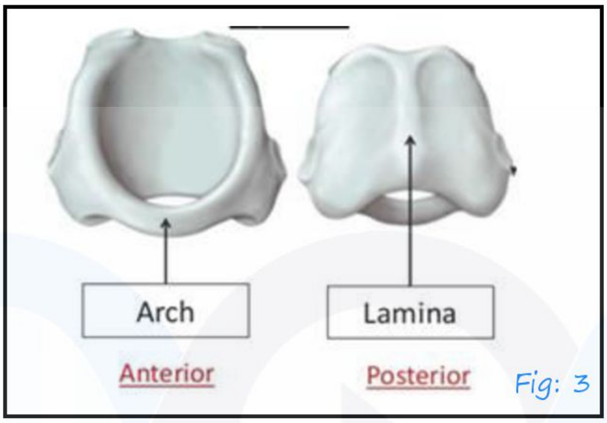

Arch
Lamina
Anterior
Posterior

Fig: 3

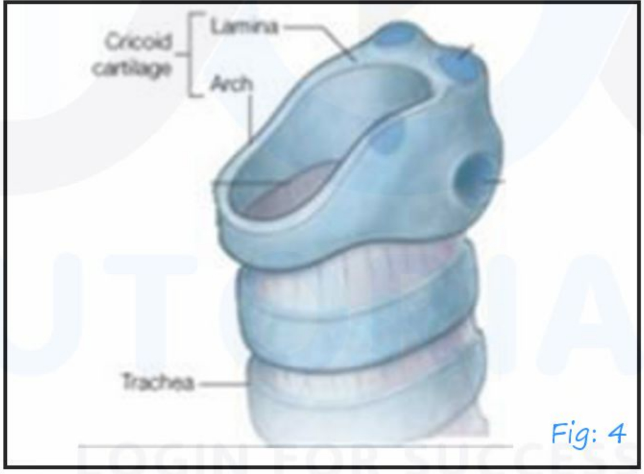

Cricoid cartilage
Lamina
Arch
Trachea

Fig: 4

3.EPIGLOTTIS

- Epiglottis is leaf like cartilage.
- It is Attached to the midpoint of thyroid cartilage inside the larynx.
- To the same midpoint, vocal cords are also attached. (See image) Basic function – Epiglottis covers vocal cards. (Epi = above, glottis = Vocal cords)

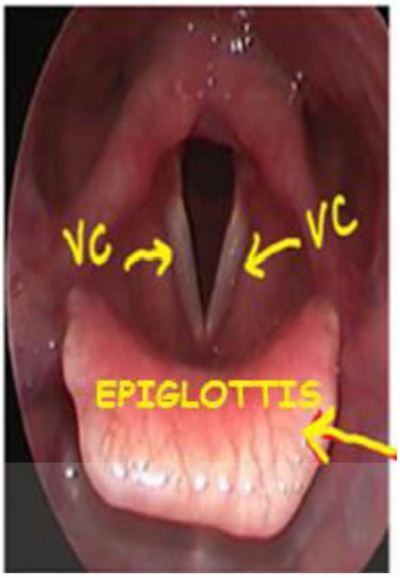
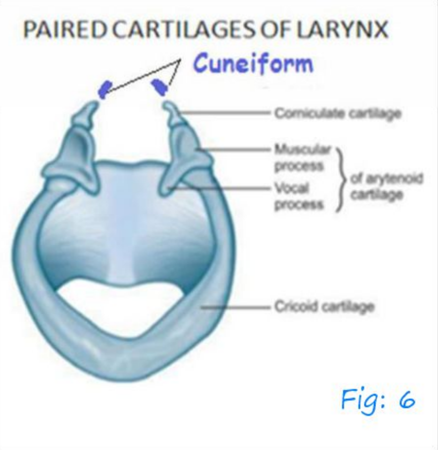

VC
VC
EPIGLOTTIS

Fig: 5

CARTILAGE (unpaired)	SHAPE
Thyroid	Open book
Cricoid	Ring like
Epiglottis	Leaf like

B. 3 Paired cartilages

B. THREE PAIRED CARTILAGES 1. Arytenoids – pebble like cartilage sitting on top of cricoid cartilage hence making cricoarytenoid joint. 2. Corniculate (rudimentary	 PAIRED CARTILAGES OF LARYNX Cuneiform Corniculate cartilage Muscular process Vocal process of arytenoid cartilage Cricoid cartilage Fig: 6

cartilages) – rice grain like cartilage 3. Cuneiform – (rudimentary cartilages) – rice grain like cartilages Corniculate& cuneiform are rudimentary cartilages sitting atop Arytenoid (see image)	

ARYTENOIDS

- Arytenoids make posterior 1/3rd of vocal cords. (ANT 2/3RD of vocal cord is membranous). It has a body, vocal and muscular processes. Laryngeal muscles attach to muscular process of arytenoid, hence causing various movements at cricoarytenoid joint.

TUTORIALS LOGIN FOR SUCCESS

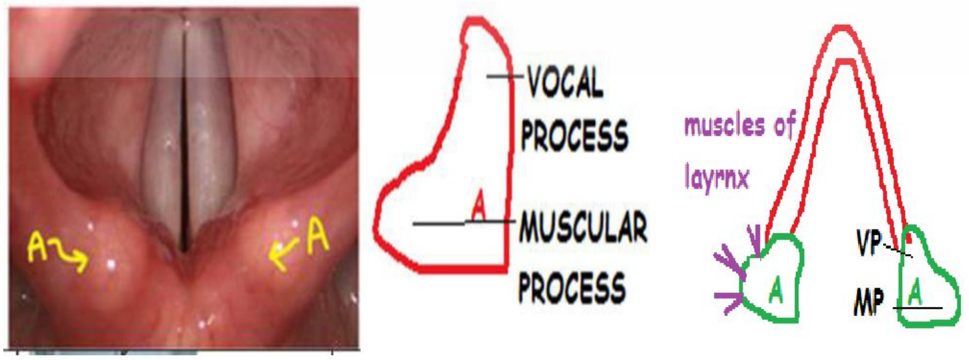
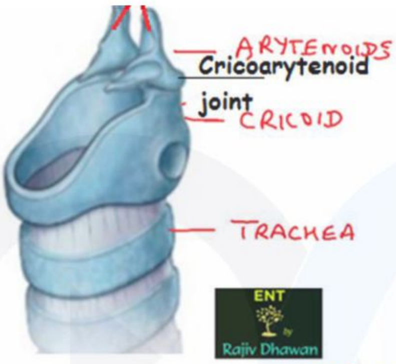

A
A
VOCAL PROCESS
A
MUSCULAR PROCESS
muscles of layrnx
VP
MP
A
A

Fig: 7

SUMMARY –

- Thyroid and cricoid form outer framework of larynx
- Epiglottis covers the VC
- Arytenoids make posterior 1/3rd of VC

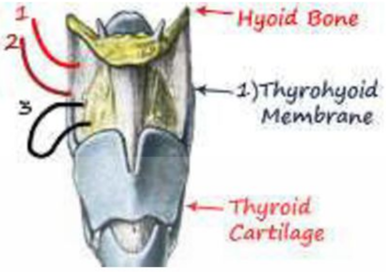
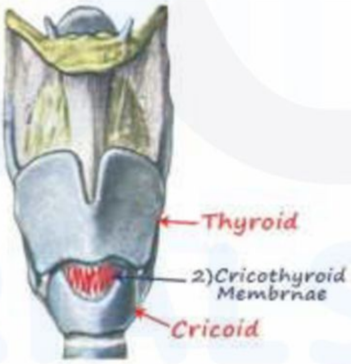
JOINTS IN LARYNX- 1. Cricothyroid joint 2. Cricoarytenoid joint- it shows rotatory and gliding movement - Both are synovial joints	 ARYTENOIDS Cricoarytenoid joint CRICOID TRACHEA ENT by Rajiv Dhawan Fig: 8

ELASTIC AND HYALINE CARTILAGE

Elastic cartilage	Hyaline cartilage
1.Epiglottis 2.Corniculate 3.Cuneiform 4.Tip of arytenoid They do not ossify with age	Rest all are hyaline cartilages They start ossifying at 25 years Therefore, laryngeal framework fractures are seen in late adult life.

MEMBRANES OF LAYRNX

Two membranes on outer surface of larynx

Thyrohyoid membrane It is pierced by Three things --2 anatomical and 1 pathological entity - Internal branch of superior laryngeal nerve - Superior laryngeal vessels. - Laryngocele (a disease)	 1 2 3 Hyoid Bone 1)Thyrohyoid Membrane Thyroid Cartilage
Cricothyroid membrane - It is the site of cricothyroidotomy. - CRICOTHYROIDOTOMY is done in acute airway obstruction when tracheostomy is going to take time. It gives airway support for maximum 48hrs time.	 Thyroid 2)Cricothyroid Membrnae Cricoid

TUTORIALS LOGIN FOR SUCCESS

Two membranes inside larynx

- Membranes inside the larynx between cartilage and mucosa support the layrnx

1.QUADRANGULAR MEMBRANE

It is from the epiglottis to the arytenoids

It forms:

Aryepiglottic folds

False vocal cards

2.CRICOVOCAL MEMBRANE

It is also called as conus elasticus. It is from Cricoid to the Vocal cord

The free edge of this membrane makes the true vocal cord when covered by the mucosa

MUCOSA OF LARYNX

- Larynx is lined by ciliated columnar epithelium, except vocal cards which are lined by stratified squamous epithelium. (see image Vocal cords have different color)
- In some smoker's vocal cords epithelium sheds faster, this condition is called keratosis larynx.

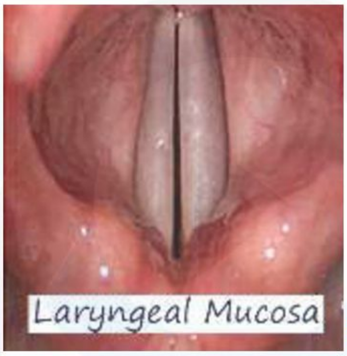


Fig: 1

Keratosis Larynx

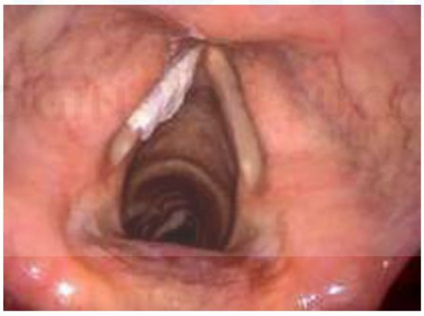
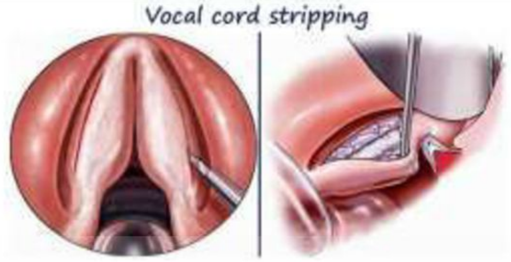


Fig: 2

- This disease is seen in smokers
- Increase in the shedding of stratified squamous epithelium of VC
- It is a premalignant condition.
- C/c- hoarse voice (c/c= chief complaint)

- Treatment- stripping of vocal cord mucosa = decortication + quit smoking.
- Other treatment- CO2 laser cordectomy


Vocal cord stripping

KERATOSIS LAYRNX Fig: 3

PITCH DISORDER OF VOICE

Normal voice features in adults-

Males	low pitch voice	Dull
Females	high pitch voice	Sharp

PUBERPHONIA

- High pitch voice in adult males (feminine).
- It is seen in emotionally labile young males.
- Rx - 1. Speech therapy (for 3 - 6 months)
- Gutzmann's maneuver- patient is asked to pull thyroid cartilage downwards and press it backwards (so that VC loosens) and then speak (speech therapy). This is done for 3 to 6 months. Psychotherapy is also needed.
- If speech therapy fails, then we do surgery called Type III Thyroplasty (It is surgical shortening or loosening of vocal cords).
- Vocal cords are attached to the midpoint of thyroid cartilage.

ANDROPHONIA

- Low pitch voice in females. (masculine)
- Surgery- Type IV Thyroplasty (It is surgical lengthening= tightening of vocal cards

SUPRAGLOTTIS AND SUBGLOTTIS

3 DIVISION OF LARYNX-

A. Supraglottis

B.Glottis

C.Subglottis

A. SUPRAGLOTTIS

- It has 5 parts
- Epiglottis-
- It is a leaf like structure which covers the Vocal cords. It extends beyond the level of hyoid bone. Hence it has 2 parts: suprahyoid and infrahyoid epiglottis.

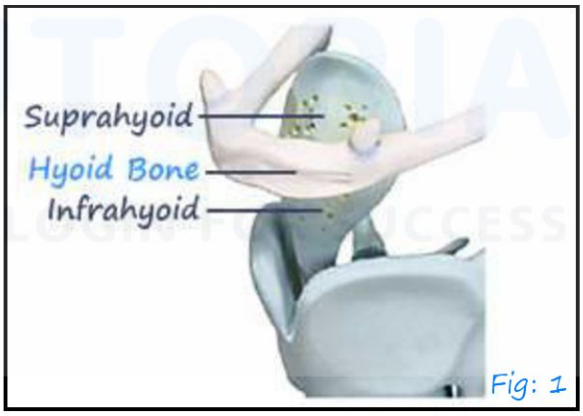


Fig: 1

- Suprahyoid epiglottis projects into the Pharynx/throat, therefore supraglottic diseases presents with pharyngeal symptoms like throat pain, dysphagia etc.

- Aryepiglottic folds (AEF). They are made by quadrangular membrane.

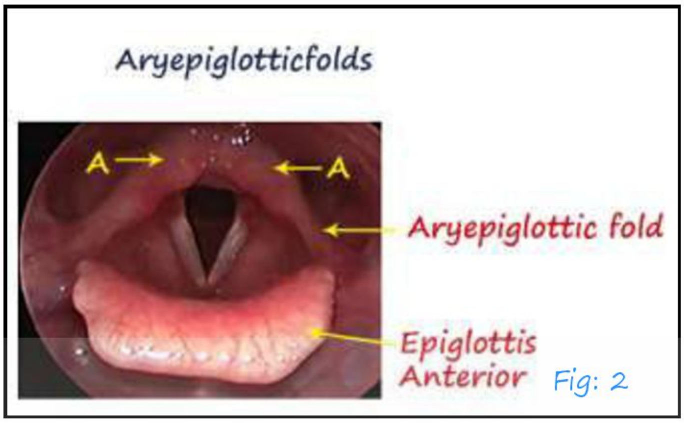

Aryepiglotticfolds
A
A
Aryepiglottic fold
Epiglottis
Anterior

Fig: 2

False vocal cards = ventricular bands (FVC)

- They are made by quadrangular membrane). They are rudimentary structures.

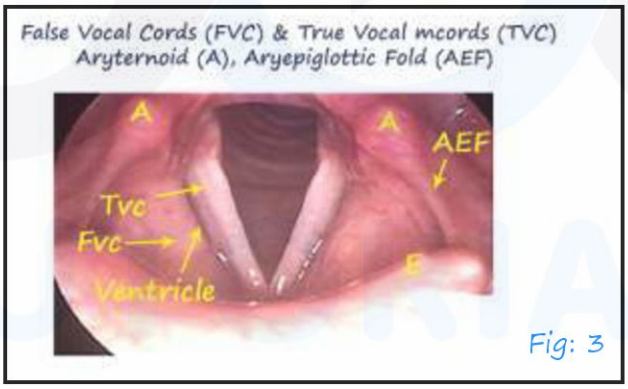

False Vocal Cords (FVC) & True Vocal mcords (TVC)
Aryternoid (A), Aryepiglottic Fold (AEF)
A
A
AEF
Tvc
Fvc
Ventricle
E

Fig: 3

- Ventricle- it is the space between true vocal cords and false vocal cords. It is a hidden area.
- 5. Saccule- it is mucosal out-pouching from the ventricle. It has rich mucosal glands; therefore, it is also called the OIL CAN OF THE LARYNX (MCQ).

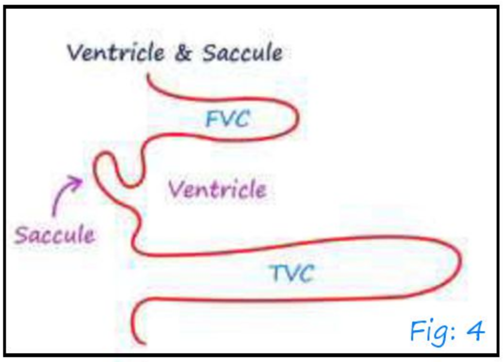

Ventricle & Saccule
FVC
Ventricle
Saccule
TVC

Fig: 4

Diseases of Supraglottis 00:10:25

Dysphonia plica ventriculitis

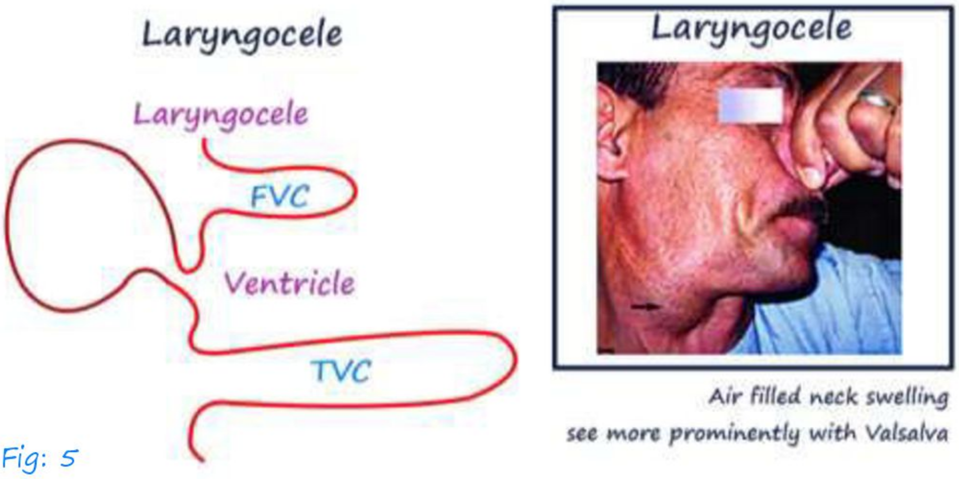
- If a patient produces sound using a false vocal card, it is a disease called Dysphonia Plica Ventricular

CAUSES:

- Mimicry artist
- TVC problem
- Rx: Speech Therapy

LARYNGOCELE

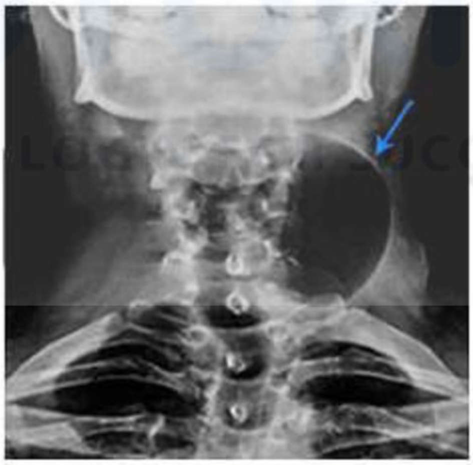
- It is abnormally dilated Saccule.
- It is a disease more common in people who play wind instruments eg: Trumpet, Bagpiper


Laryngocele
Laryngocele
FVC
Ventricle
TVC
Laryngocele

Air filled neck swelling see more prominently with Valsalva

Fig: 5

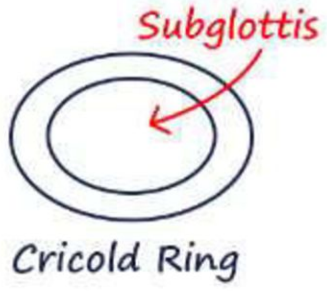
- It pierces Thyrohyoid membrane and appears as an air-filled neck swelling, called as EXTERNAL LAYRNGOCELE. (MCQ)
- Examination- Bryce's sign This is the sound of air leak produced when Laryngocele is pressed
- Investigation – x ray soft tissue neck with VALSALVA. (MCQ)



Xray soft tissue neck with valsalva showing laryngocoele (Blue Arrow) Fig: 6

- Treatment – Surgical excision

B. Subglottis

SUBGLOTTIS It is the empty space inside the Cricoid ring. It is only the air-filled space.	 Subglottis Cricold Ring

GLOTTIS

- C. Glottis = True vocal cords = vocal cords
- Length

  - Male – 18 – 23mm

  - Female – 16 – 17mm
- VC are Attached to the midpoint of thyroid cartilage
- VC Start at the thyroid and end at the Arytenoid
- Posterior commissure is also called as INTER ARYTENOID AREA
- Which muscle of larynx is a single/ unpaired muscle – IA muscle (MCQ)

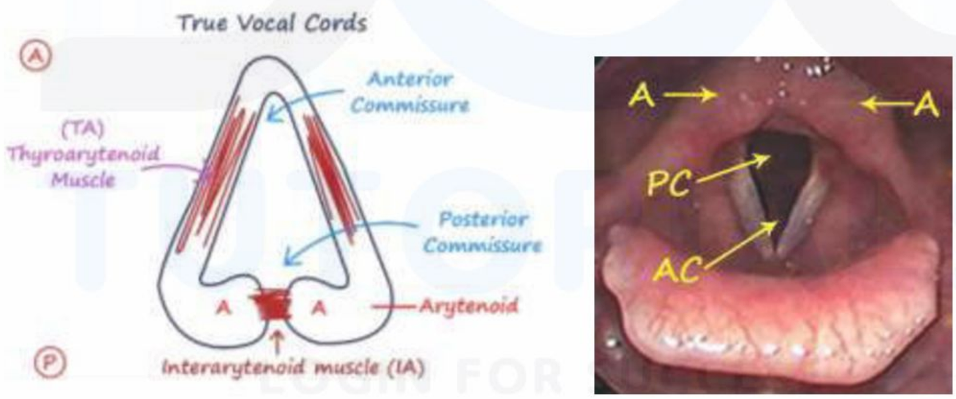

True Vocal Cords
A
(TA)
Thyroarytenoid Muscle
Anterior Commissure
Posterior Commissure
A
A
Arytenoid
P
Interarytenoid muscle (IA)
A
A
PC
AC

Fig: 1

- Thyroarytenoid and interarytenoid are adductor muscles.
- If they are weak, closure will be incomplete; it will lead to a disease called PHONASTHENIA. It will lead to gap between vocal cards even after adduction. This appearance of gap is called Key Hole glottis.

- The key hole has 2 components
- Elliptical gap is due to TA.
- Triangular gap is due to IA
- Treatment- speech therapy

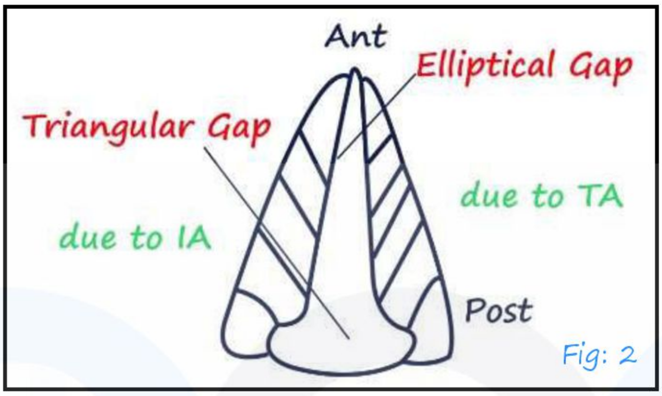

Ant
Elliptical Gap
Triangular Gap
due to TA
due to IA
Post

Fig: 2

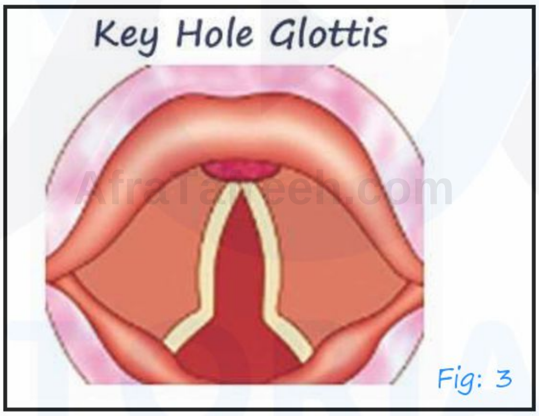

Key Hole Glottis

Fig: 3

Cut Section of Vocal Card (see image below)

00:10:18

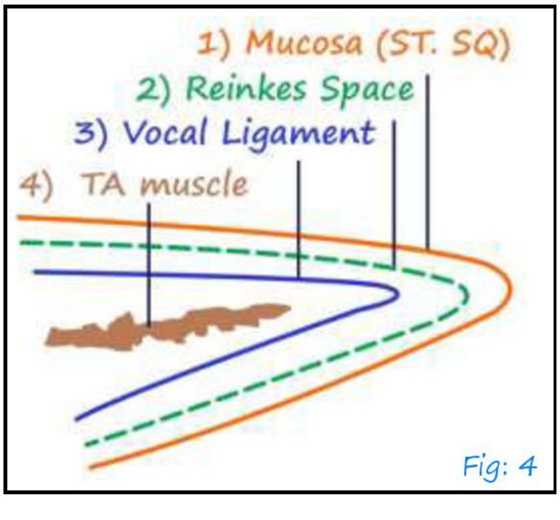

1) Mucosa (ST. SQ)
2) Reinkes Space
3) Vocal Ligament
4) TA muscle

Fig: 4

Types of cordectomy –

- Type I – sub-epithelial
- Type II – Sub-ligamental (MCQ)
- Type III – Transmuscular
- Type IV – Total
- Type V – extended (VC + epiglottis)

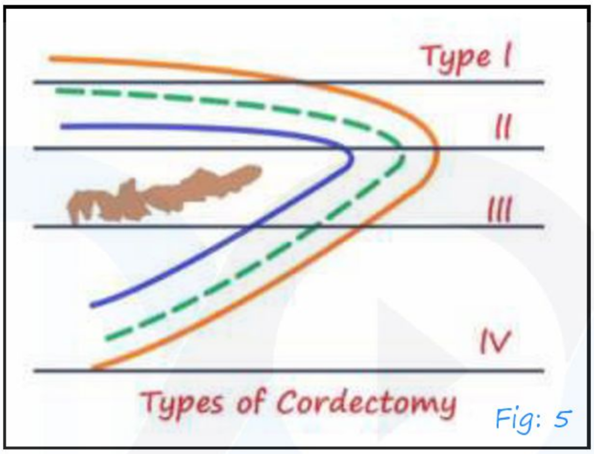
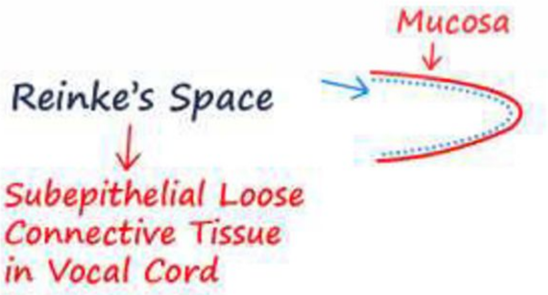

Type I
II
III
IV
Types of Cordectomy

Fig: 5

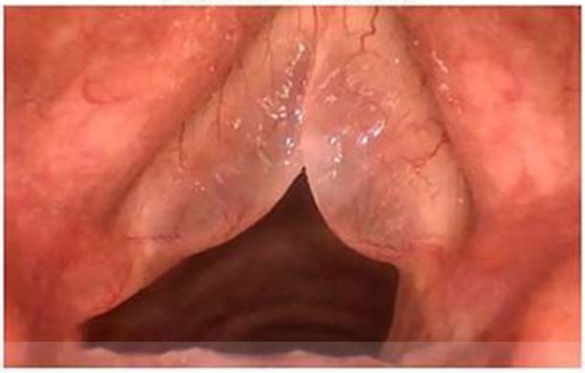
DOC TUTORIALS LOGIN FOR SUCCESS

REINKE'S SPACE 00:15:45

- REINKE'S SPACE
  - Sub-epithelial loose connective tissue in vocal cords.


Mucosa
Reinke's Space
Subepithelial Loose Connective Tissue in Vocal Cord

REINKE'S EDEMA



REinke's Edema

Fig: 6

- It is edema of Reinke's space. It is bilateral diffuse swelling of vocal cords.
- It is also called smoker's polyp of larynx

Causes

- Smoking
- (Most common cause)
- Hypothyroidism
- Vocal abuse
- C/C-hoarse voice
- Treatment- surgery in the form of stripping of vocal cord mucosa (also called as Decortication). This is done on one vocal cord at a time
- If we remove both VC together then there will be adhesion / synechiae formation between two vocals

Vocal nodules 00:23:05

- (Singer's nodules = screamers nodules= teachers' nodules)
- Causes:
  - Vocal abuse (most common cause)
  - Laryngopharyngeal reflux (LPR)
  - Site- junction of anterior $1/3^{rd}$ and posterior $2/3^{rd}$ (this is because of the reason that this is the most vibrating part of the vocal cords)

Vocal Nodules

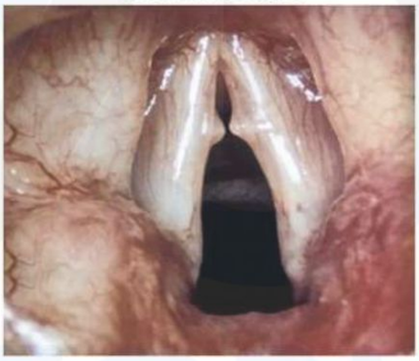


Fig: 7

- C/C- hoarse voice
- They are always bilateral
- Rx- Speech therapy which includes voice rest (+/- proton pump inhibitors eg: Omeprazole). Micro laryngeal surgery is only indicated if disease does not respond to conservative management.

Vocal polyp 00:28:23

- Its cause, site and chief complaints are same as vocal nodule.

Vocal Polyp

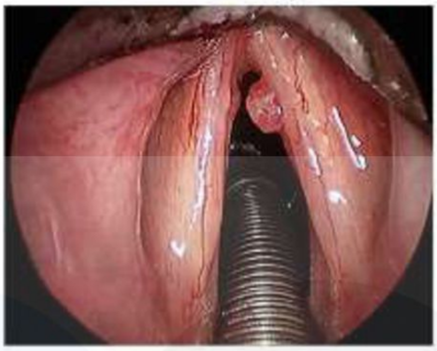


Fig: 8

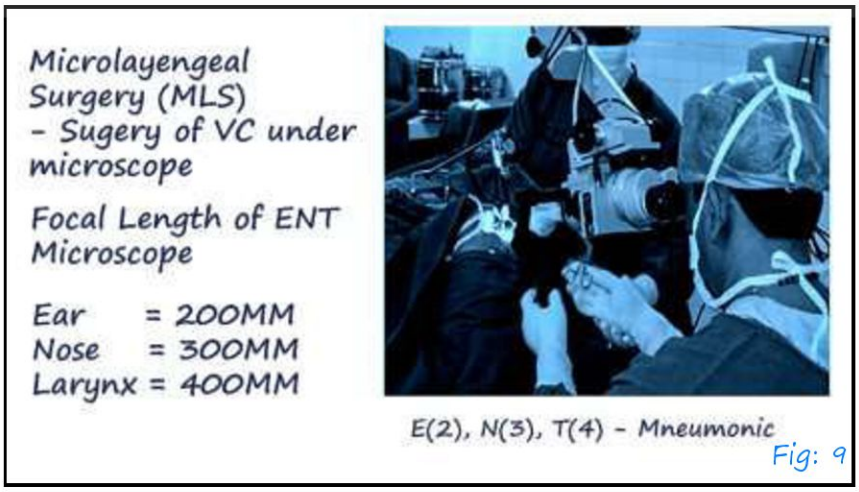
- C/C-

  1.hoarse voice

  2.This patient may additionally complain of double voice (Diplopodia)

  3.It is unilateral

Treatment – MLS (Microlaryngeal surgery) followed by speech therapy



Microlayengeal Surgery (MLS)
- Sugery of VC under microscope

Focal Length of ENT Microscope

Ear = 200MM
Nose = 300MM
Larynx = 400MM

E(2), N(3), T(4) - Mneumonic

Fig: 9

Intubation granuloma 00:35:15

- Cause- iatrogenic (faulty or prolonged intubation) e.g. After surgery under general anaesthesia, ICU patient on ventilator
- It is mostly bilateral entity
- Site- junction of anterior 2/3rd and posterior 1/3rd.
- Rx- Microlaryngeal surgery

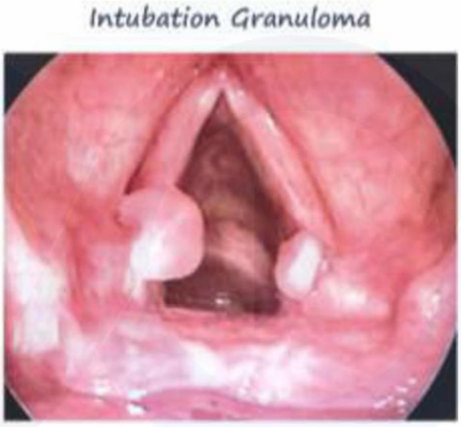
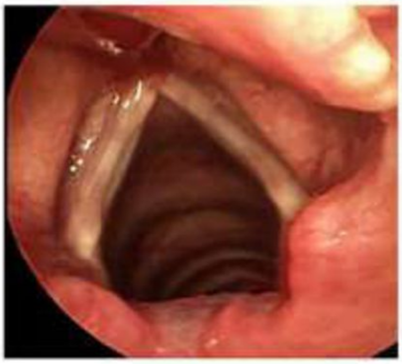
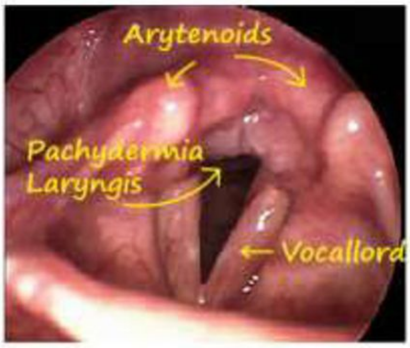


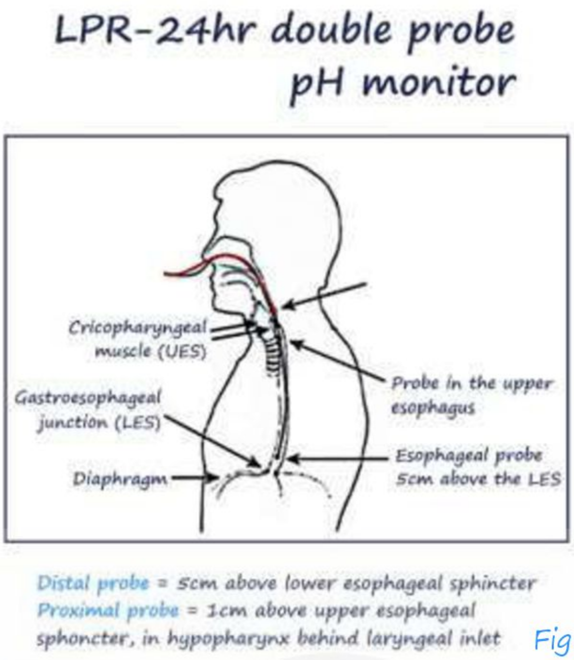
Fig: 10

It is temporary fold on vocal cord mucosa. Temporary means it is not attached to underlying vocal ligament	This is a disease which involves heaping of epithelium in interarytenoid area (posterior commissure).
Etiology- LPR (Laryngopharyngeal reflux).	Cause is LPR (Laryngopharyngeal reflux).
Treatment- PPI (proton pump inhibitors).	Treatment- PPI (proton pump inhibitors).
	This is not a premalignant condition.

Pseudosulcus Vocalis	Pachydermia Laryngis
	

Laryngopharyngeal reflux 00:42:52

- It is sequlae of GER.
- Diagnostic test (MCQ) - is 24hour double probe pH monitoring.
- 1st probe (lower probe) lying 5cm above lower esophageal sphincter. 2nd probe (upper probe) lies 1cm above upper esophageal sphincter.
- LPR can cause
  - Vocal nodule
  - Vocal polyp
  - Pseudosulcus vocalis.
  - Pachydermia Laryngis.
  - Chronic laryngitis.
  - Subglottic stenosis.
  - Cancer Larynx.
  - Chronic throat pain.
  - Chronic dry cough.



LPR-24hr double probe pH monitor

Cricopharyngeal muscle (UES)
Gastroesophageal junction (LES)
Diaphragm
Probe in the upper esophagus
Esophageal probe 5cm above the LES

Distal probe = 5cm above lower esophageal sphincter
Proximal probe = 1cm above upper esophageal sphoncter, in hypopharynx behind laryngeal inlet

Fig: 11

Juvenile papilloma of larynx (JPL/RRP) 00:45:16

- (= Recurrent respiratory papillomatosis)

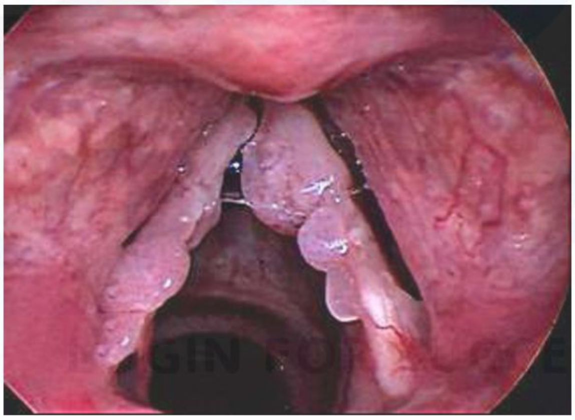


Fig: 12

- Etiology- it is causes by HPV- 6, 11. (Human Papilloma Virus)
- This disease is more common in children in 4-6 years of age.
- Source of infection is mother with genital HPV warts at the time of delivery.
- Examination- viral warts on vocal cords.

- These warts can also spread to trachea and bronchi.
- This is a pre malignant disease.
- C/c – 4-6 years of age child with Chronic hoarseness of voice. +/– respiratory difficulty. (If they block the laryngeal inlet)
- Treatment – MLS (micro-laryngeal surgery) with CO2 laser excision. Unfortunately, recurrence is very common

Agents used to decrease recurrence of JPL.

- Intralesional cidofovir.
- Indole 3 carbinol.
- Interferon alpha 2A
- Bevacizumab
- Cis-retinoic acid.
- CO2 laser is invisible laser and it has wave length of 10,600nm. It is most commonly used laser in ENT Surgery.

Adult papilloma of larynx 00:55:48

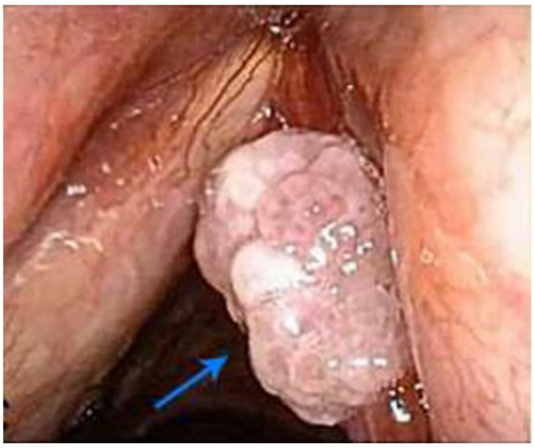


Fig: 13

- They are single, smaller and on one side.
- They are mostly seen on the anterior part of the vocal cord or anterior commissure area.
- They do not recur after surgery
- Rx: Microlaryngeal surgery.

LYMPHATIC DRAINAGE AND SPACES OF LARYNX

- Glottis-vocal cords don't have lymphatics. So, prognosis will be better for the pure glottic cancers due to no neck node metastases.
- Supra glottis- it has rich lymphatics. They drain into level II and III neck nodes.
- Subglottis- it drains into pre-tracheal/ pre-laryngeal/ Delphian / level VI lymph nodes (anterior compartment lymph nodes).

Two hidden spaces in larynx

- We cannot see them in endoscopy.
- We can only see them in CT scans.

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Pre epiglottic space (space of Boyer)

- This is the space between thyroid cartilage and epiglottis. (Look at the yellow fat in image)
- Boundaries
- Anterior- thyroid cartilage, thyrohyoid membrane
- Posterior- epiglottis
- Superior- hyoepiglottic ligament.
- This space is filled up with fat and areolar tissue. Cancer larynx can invade the pre- epiglottic space.

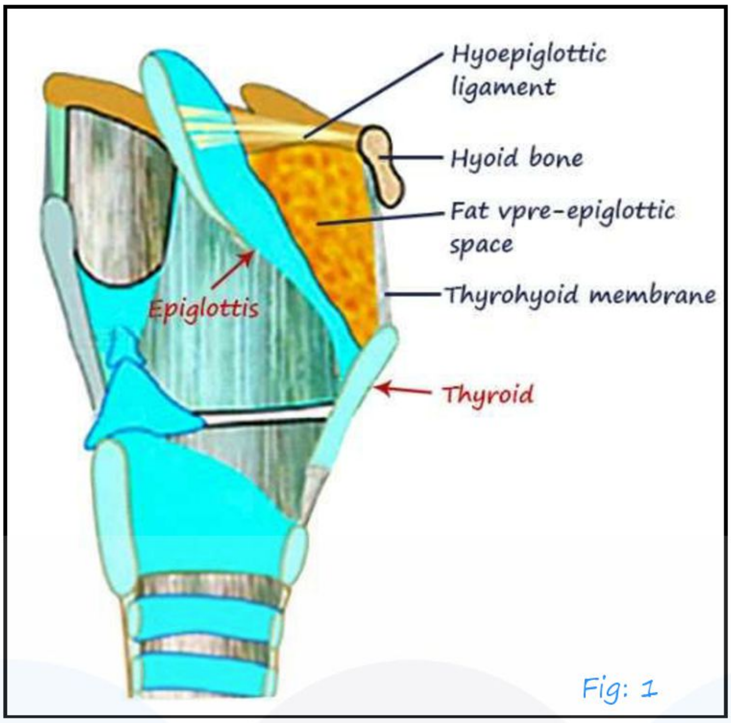

Hyoepiglottic ligament
Hyoid bone
Fat vpre-epiglottic space
Thyrohyoid membrane
Epiglottis
Thyroid

Fig: 1

Paraglottic space (space of tucker)

- Boundaries
- Medial - quadrangular membrane and cricovocal membrane
- Lateral - thyroid cartilage
- Posterior - Pyriform sinus
- Pre epiglottic and para glottic spaces communicate with each other

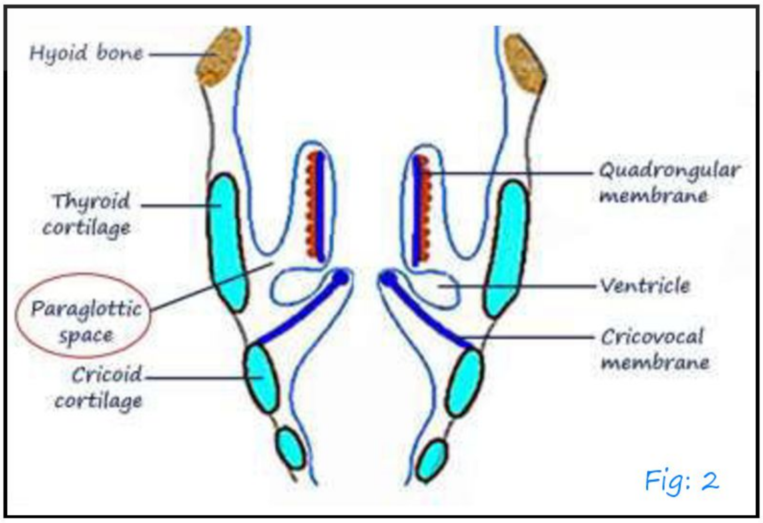

Hyoid bone
Thyroid cortilage
Paraglottic space
Cricoid cortilage
Quadrongular membrane
Ventricle
Cricovocal membrane

Fig: 2

- These spaces can be seen on CT scan

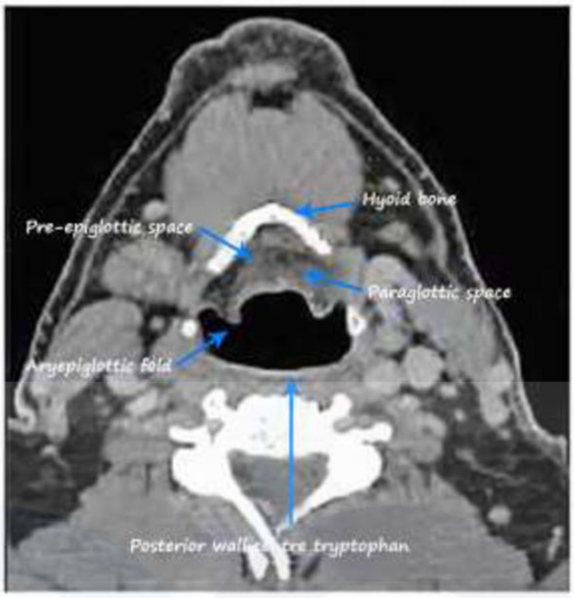

Hyoid bone
Pre-epiglottic space
Paraglottic space
Aryepiglottic fold
Posterior wall of the tryptophan

Fig: 3

Embryological development of larynx 00:10:30

- 4TH and 6th brachial arches (4-SLN, 6-RLN)
- Epiglottis develops from hypobranchial eminence

DIFFERENCE BETWEEN PEDIATRIC AND ADULT LARYNX

	Pediatric	Adult
Position	High C2-C3 level (MCQ)	Low C3-c6 level
Narrowest part	Subglottis.	Glottis.
Sub-mucosal loose connective tissue	Abundant Therefore, pediatric laryngeal infection can lead to airway emergency.	Scanty

Stridor

- Stridor means noisy breathing
- Cause - airway obstruction.
- This is of 3 types depending on level of obstruction.

Type of stridor	Level of obstruction
Inspiratory stridor	Pharynx, Supraglottis.
Biphasic stridor	Glottis, Subglottis, cervical trachea
Expiratory stridor	Lower trachea, Bronchi

- Higher the blockage – inspiratory stridor
- Lower the blockage – expiratory stridor
- Middle level blockage – biphasic stridor

Pediatric laryngeal infections 00:08:11

- These are airway emergencies because of abundant subcutaneous loose connective tissue that can lead to laryngeal edema.

Acute epiglottitis-

- This is infection of supraglottis.
- Cause is streptococcus pneumoniae (most common) and H. Influnzae B (2nd most common.)
- Seen in age group of 2-7 years.
- C/p (clinical picture) -
  - Very sick baby
  - High fever.
  - Respiratory distress.
  - Inspiratory stridor.
  - Drooling of saliva (due to pain patient is not able to swallow saliva)
  - Hot Potato/Plummy voice (as if the child is holding a plum in the throat)
  - Airway obstruction, to decrease the problem, the child will be sitting on the emergency bed with his hands out stretched and placed on the bed and

the child will bend forwards. By doing this, epiglottis falls away from the vocal cord and the airway is at least partially open. When viewed from the side, it is called as Tripod sign

- X ray soft tissue neck lateral view shows thumb sign which means swollen epiglottis
- Treatment –
  1. The first treatment of acute epiglottitis is airway management by urgent intubation. In case intubation is not possible due to edema, we need to go for tracheostomy. Avoid repeated laryngoscopy because it will increase the edema.
  2. Steroids – to reduce edema
  3. Antibiotics

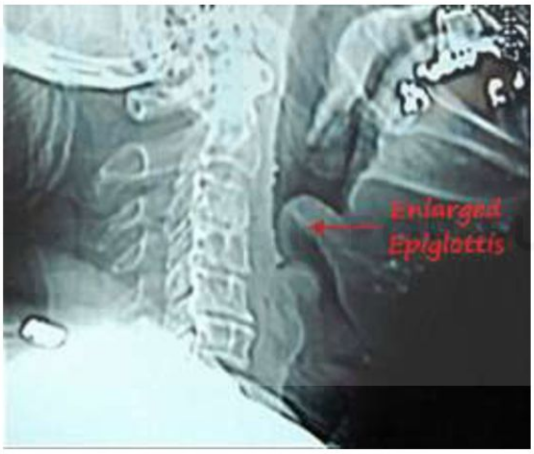


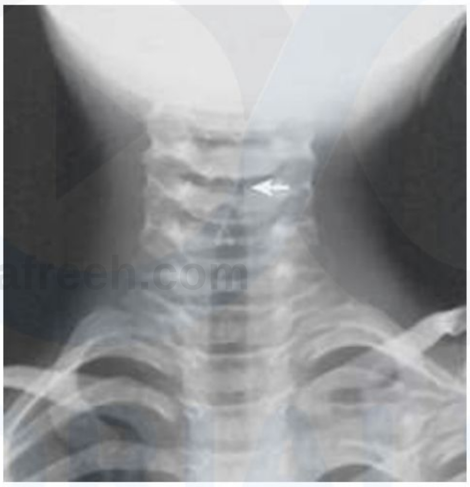
Fig: 1

Acute laryngotracheobronchiitis (ALTB) or croup

- It is infection of complete airway but subglottis is most affected area.
- Causative organism – Parainfluenza virus.
- Age group is 3months to 3 years.

- Boys more commonly involved than girls.
- C/p-
  - Respiratory difficulty.
  - Biphasic stridor.
  - Low fever.
  - Barking cough.

Epiglottitis is more dangerous than Croup

• X-ray soft tissue neck AP view shows STEEPLE SIGN (it is narrowing of subglottis). • Treatment - Airway management. - Bronchodilator. - Steroids. - Antibiotics – to prevent secondary infection	 **STEEPLE SIGN**

TUTORIALS LOGIN FOR SUCCESS

Laryngeal diphtheria

<table>
<tr>
<td>

- Secondary to faucial (oropharyngeal) diphtheria
- Pseudomembranous in larynx, trachea, and tonsillar region.
- Pseudo membrane is greyish and bleeds on removal
- C/f–
  - Fever
  - Bull neck, cervical lymphadenopathy
  - Airway obstruction due to this membrane. Therefore, patient might need tracheostomy.

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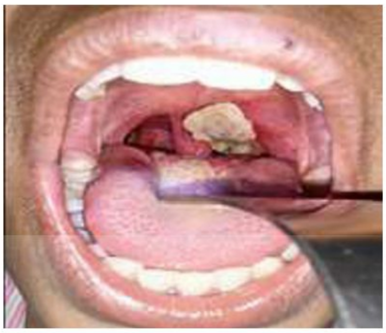
<td></td>
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TUTORIALS LOGIN FOR SUCCESS

PEDIATRIC LARYNGEAL INFECTIONS

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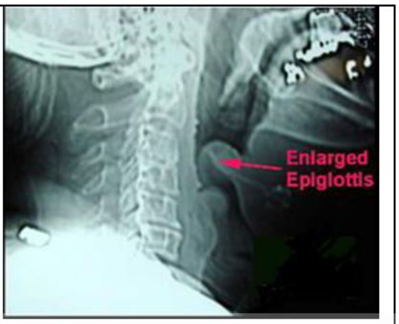
• X ray soft tissue neck lateral view shows thumb sign which means swollen epiglottis - Treatment – 1. The first treatment of acute epiglottitis is airway management by urgent intubation. In case intubation is not possible due to edema, we need to go for tracheostomy. Avoid repeated laryngoscopy because it will increase the edema. 2. Steroids – to reduce edema 3. Antibiotics	

DOC TUTORIALS LOGIN FOR SUCCESS

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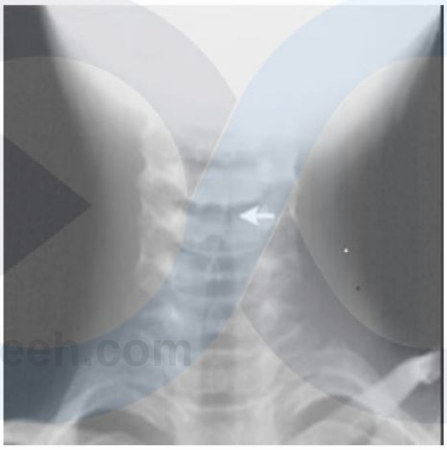
• X-ray soft tissue neck AP view shows STEEPLE SIGN (it is narrowing of subglottis). • Treatment - Airway management. - Bronchodilator. - Steroids. - Antibiotics – to prevent secondary infection	 STEEPLE SIGN

DC TUTORIALS
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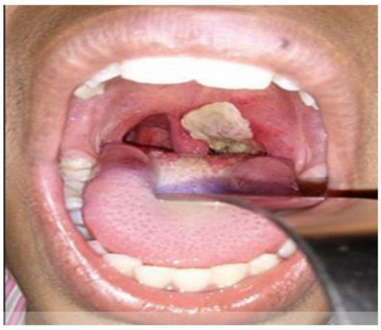
• Secondary to faucial (oropharyngeal) diphtheria • Pseudomembranous in larynx, trachea, and tonsillar region. • Pseudo membrane is greyish and bleeds on removal • C/f- - Fever - Bull neck, cervical lymphadenopathy - Airway obstruction due to this membrane. Therefore, patient might need tracheostomy.	

CONGENITAL DISEASES OF LARYNX

Laryngomalacia

- It is the most common congenital disease of larynx.
- Most common congenital anomaly
- Most common cause of neonatal stridor
- It is weakness of supraglottis.
- Examination findings
  - Supraglottic collapse during inspiration (supraglottis is weak in this child. Inspiration is a negative pressure and creates a vacuum, this vacuum causes supraglottic wall to collapse during inspiration)
  - Omega shaped epiglottis (folded).

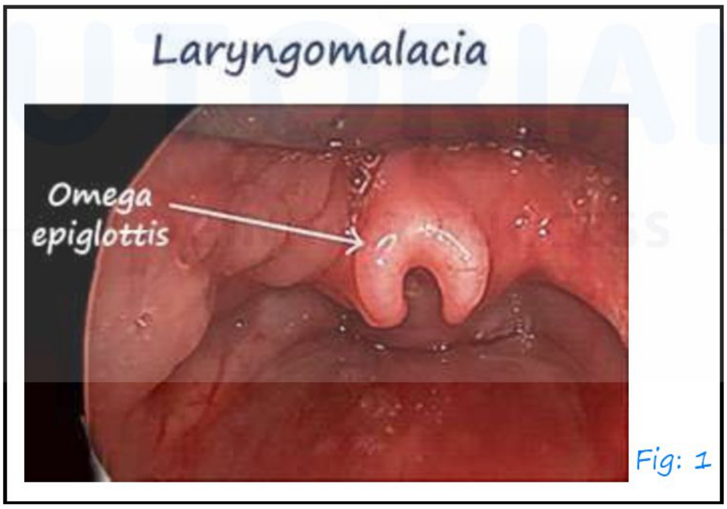


Fig: 1

- C/c (chief complain) – inspiratory stridor, its features
  - It appears by first week of life.
  - It increases on crying (which is deep inspiration).

  - It decreases in prone position (in supine, epiglottis covers the VC too much and lot of blockages of supraglottis. In prone, epiglottis falls downwards and supraglottis will be partially open).
  - Normal cry, because vocal cords are normal.
- Treatment is conservative (no cyanosis/ hypoxia). Reassurance, that it is self-limiting condition,
- More than 90% patients improve by 12 - 18 months of age.
- If no improvement with age, then we do surgery called supraglottoplasty or epiglottopexy.

Summary of laryngomalacia

Laryngomalacia

- Most common congenital disease of larynx
- Weakness of supraglottis
- Subglottic collapse during inspiration
- Omega shaped epiglottis
- c/c inspiratory stridor
- Stridor appears by 1st week of like
- Stridor decreases in prone position
- Stridor increase in crying
- Normal cry of body
- Treatment: conservative, self-limiting by 12 -18 months, supraglottoplasty

TUTORIALS LOGIN FOR SUCCESS

Congenital glottic web

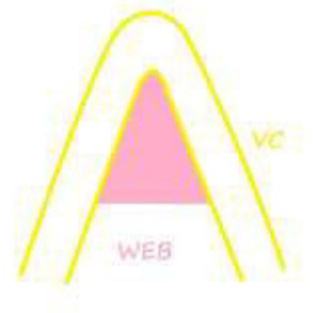
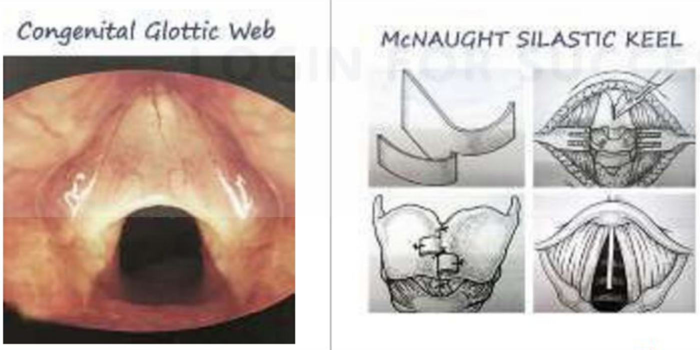


Fig: 2

- This is due to incomplete canalisation of glottic area
- This is the most common site of laryngeal web
- C/c - hoarse cry. (VC is affected, hence, sound problem)
- Treatment is CO2 laser excision. Followed by placement of mc naught silastic keel for few days in between vocal cords for re-epithelization and to prevent reformation of web.


Congenital Glottic Web

McNAUGHT SILASTIC KEEL

Fig: 3

Congenital subglottic hemangioma

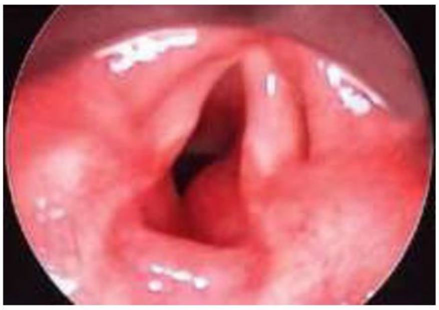


Fig: 4

- It is capillary haemangioma in the subglottic area
- It is sometimes associated with facial haemangioma. (In jaw area)
- C/c–
  - Respiratory difficulty.
  - Stridor.
  - Cry is mostly normal.
- Immediate treatment – the child may need tracheostomy at birth if significant airway compromise is there. Then wait and watch because hemangioma can spontaneously regress with age. If no improvement then co2 laser excision

Congenital subglottic stenosis

- Subglottis is the empty space in the cricoid ring. The diameter of cricoid ring is subglottic diameter.

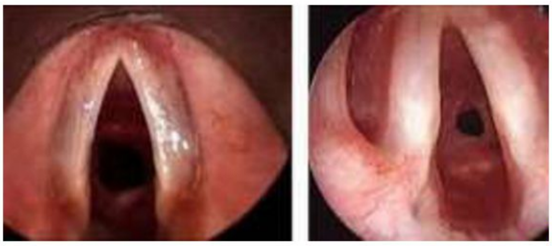


Fig: 5

- If this diameter is less than 3mm in preterm baby or less than 4mm in full term baby then it is called congenital subglottic stenosis.

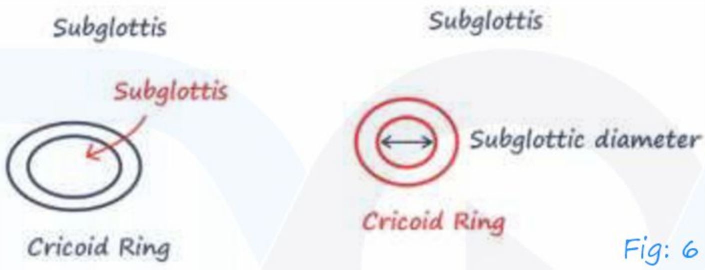

Subglottis
Subglottis
Cricoid Ring
Subglottis
Subglottic diameter
Cricoid Ring

Fig: 6

- Cotton Myer grading. Of congenital subglottic stenosis

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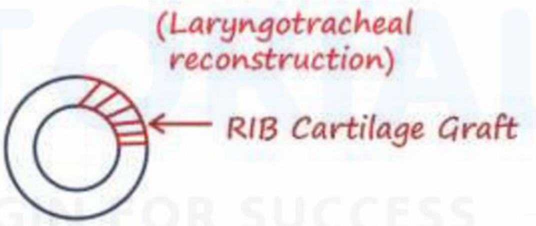
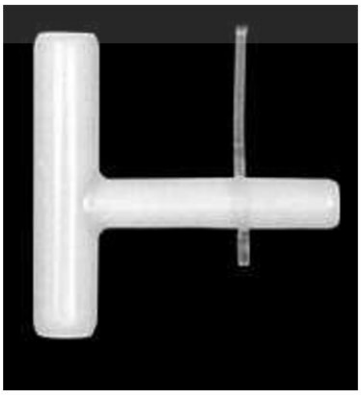
Grade	%Age of obstruction
I	0 - 50%
II	51 - 70%
III	71 - 99%
Iv	No lumen.

Treatment

Grade I	Conservative.
Grade II	Laser/dilatation Followed by topical application of mitomycin c (anti-fibroblastic thereby preventing re-stenosis).
Grade III & Grade IV	Surgery called laryngotracheal reconstruction (LTR). Increase diameter of ring by putting rib cartilage graft followed by placement of Montgomery's silicone tracheal t-tube for few days to support the graft.  (Laryngotracheal reconstruction) RIB Cartilage Graft 

METHODS OF LARYNGEAL EXAMINATION

Indirect laryngoscopy (I/L)

- This is done with the help of indirect laryngoscopy mirror. The mirror should be warmed before using it; otherwise, it will be fogged. Before using, check the shaft and back of mirror temperature on the back of your hand.

Indirect Laryngoscopy Mirror

Fig: 1

Structures not visible on indirect laryngoscopy-(VIVA/MCQ)

- Anterior commissure of vocal cords
- Laryngeal surface of epiglottis (undersurface)
- Under surface of vocal cords
- Adjoining area of subglottis.
- Ventricle and saccule.
- Apex of pyriform sinus.

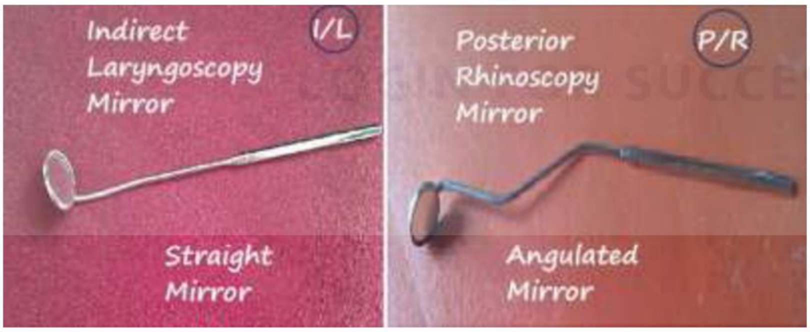

Indirect
Laryngoscopy
Mirror
I/L
Straight
Mirror
Posterior
Rhinoscopy
Mirror
P/R
Angulated
Mirror

Fig: 2

Fiberoptic laryngoscopy (FOL)

- Done with help of a flexible endoscope.
- Endoscope is passed through nose or mouth.
- It is done in OPD.

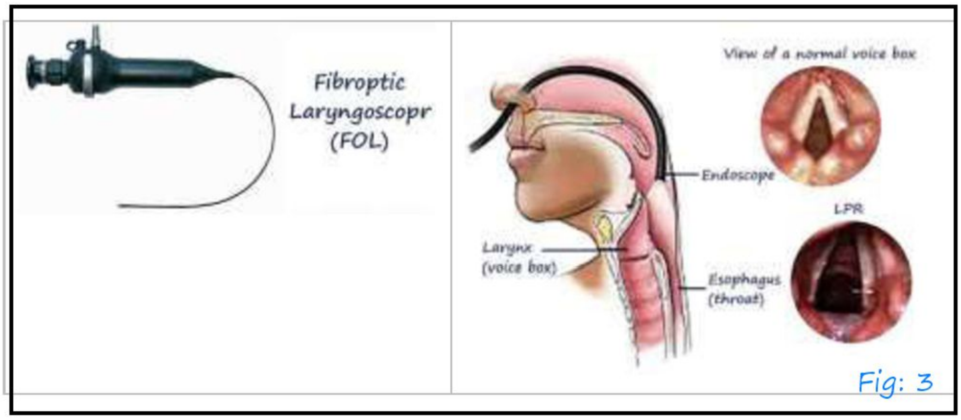

Fibroptic Laryngoscopr (FOL)
View of a normal voice box
Endoscope
LPR
Larynx (voice box)
Esophagus (throat)

Fig: 3

Rigid endoscopy of larynx

- Done with help of 70° or 90° rigid endoscope. It is passed through mouth only.

90° Rigid Endoscope (for Larynx)

Fig: 4

Videostroboscopy

- This technique involves the endoscopic examination of vocal cord with flashing light so that vocal cord movements appear in slow motion.
- It also shows sound wave formation on vocal cord. This sound wave form should be regular, symmetrical and periodic.
- If any lesion of the vocal card makes this waveform irregular, then it is most likely malignant lesion.

TUTORIALS LOGIN FOR SUCCESS

Direct laryngoscopy

- Done in OT. Here you directly visualize the larynx.
- Boyce position (barking dog position)
- Here, the neck is flexed on chest and head is extended on neck (Atlanta – occipital joint)

VOICE DISORDERS

1.Functional/hysterical aphonia

- Patient is pretending the symptom of loss of voice, (actually voice is absolutely normal.)
- Psychological problem
- This disease is more common in young females (around 15-30 years).
- How to prove the diagnosis?
- Cough sound is normal and this proves diagnosis.
- Examination- normal vocal cord movements.
- Treatment is psychotherapy.

2. Mogiophonia

- Psychiatric issue
- It is speech problem in public appearance only.
- Treatment - behavioral therapy

3. Nasal intonation

- They are of 2 types

  a. Rhinolalia aperta

  b. Rhinolalia clausa

Rhinolalia aperta/hypernasality

- It is seen in palatal disorders.
- Nasal element is more in the voice – hypernasality

- Palate separates the nose air from the mouth, therefore if palate is defective, air will mix from nose and mouth
- Causes:
  - Cleft palate.
  - Submucosal cleft palate.
  - Palatal perforation.
  - Palatal paralysis.
  - Bifid uvula.
  - Palatal weakness/ velopharyngeal insufficiency
  - (Aperta has p. P for – palate)

Rhinolalia clausa/hyponasality

- Nasal air can't reach the mouth due to anything that can block the nose
- Causes
  - Nasal polyp.
  - Sinusitis.
  - Adenoid hypertrophy.
  - Angiofibroma

4.spasmodic dysphonia

- It is a neurological disorder.
- It is a type of laryngeal dystonia.
- Vocal cord muscles go into spasm intermittently and involuntarily.
- It is of 2 types

TUTORIALS LOGIN FOR SUCCESS

Adductor spasmodic dysphonia	Abductor spasmodic dysphonia
Patient has strangulated or choked voice	Patient has breathy voice.
VC are closed at the time of spasm	VC are open at the time of spasm
Hyperadducted	Air leaking through abducted area
This is more common type.	Less common
Treatment- repeated botulinum toxin injection (under electromyography guidance).	Treatment- repeated botulinum (can break spasm) toxin injection (under electromyography guidance).

FUNCTIONS OF LARYNX

Functions of larynx 00:00:15

- Primary function of the larynx is protection of the lower airway (prevents aspiration pneumonia)
- Phonation means sound production-
- Sound is produced from true vocal cords, in adducted position, during expiration phase of respiration. This is called AERODYNAMIC MYOELASTIC THEORY of phonation.
- 3. Chest fixation is done against closed glottis for certain actions like coughing, vomiting, defecation.

Muscles of larynx 00:05:15

- Intrinsic muscles of larynx (3 groups)

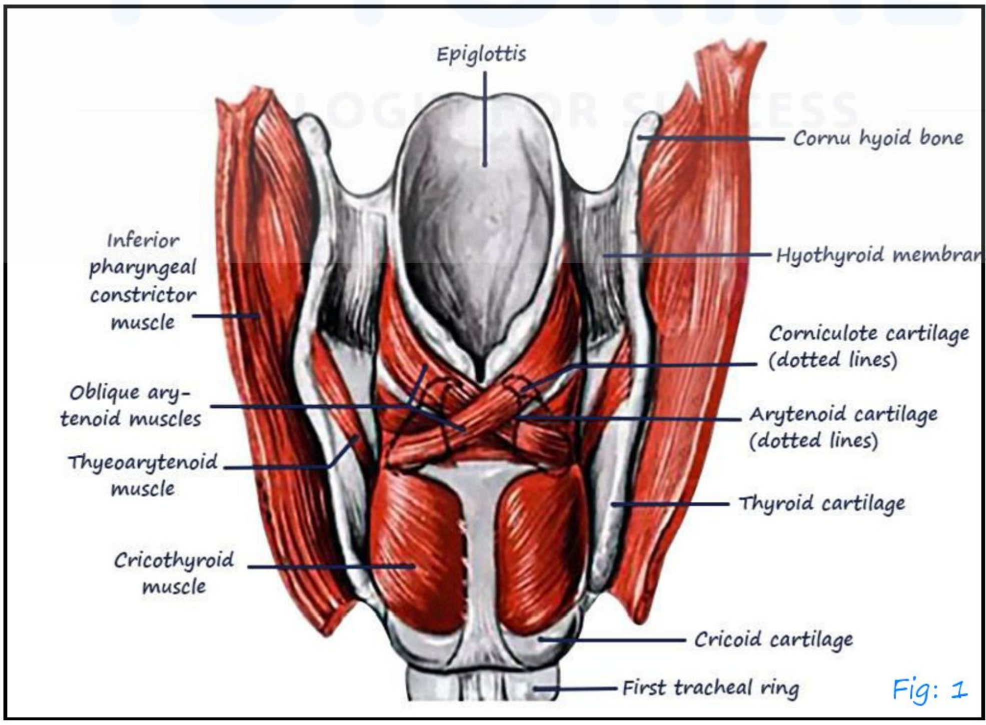

Epiglottis
Cornu hyoid bone
Inferior pharyngeal constrictor muscle
Hyothyroid membrane
Corniculote cartilage (dotted lines)
Oblique ary-tenoid muscles
Arytenoid cartilage (dotted lines)
Thyeoarytenoid muscle
Thyroid cartilage
Cricothyroid muscle
Cricoid cartilage
First tracheal ring

Fig: 1

Abductor muscles (single)

- Posterior cricoarytenoid (MCQ)
- It is only abductor muscle of vocal cord

Adductor muscles (four)

- Lateral cricoarytenoid
- External part of Thyroarytenoid (muscle within the VC)
- Interarytenoid
- Cricothyroid (also a tensor)

Tensor muscles (two)

- Cricothyroid (main tensor of vocal cord)
- Internal part of Thyroarytenoid (Vocalis muscle)
- Function – Tensor muscles give quality of voice (Timber)
- All these muscles lie inside the larynx except Cricothyroid muscle.

Motor nerve supply of larynx 00:14:55

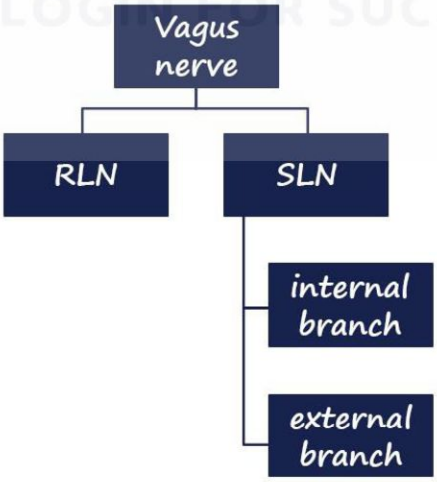
- All these muscles are supplied by RECURRENT LAYRNGEAL NERVE (RLN) except Cricothyroid which is supplied by external branch of Superior laryngeal nerve (SLN)

Sensory supply of larynx 00:16:39

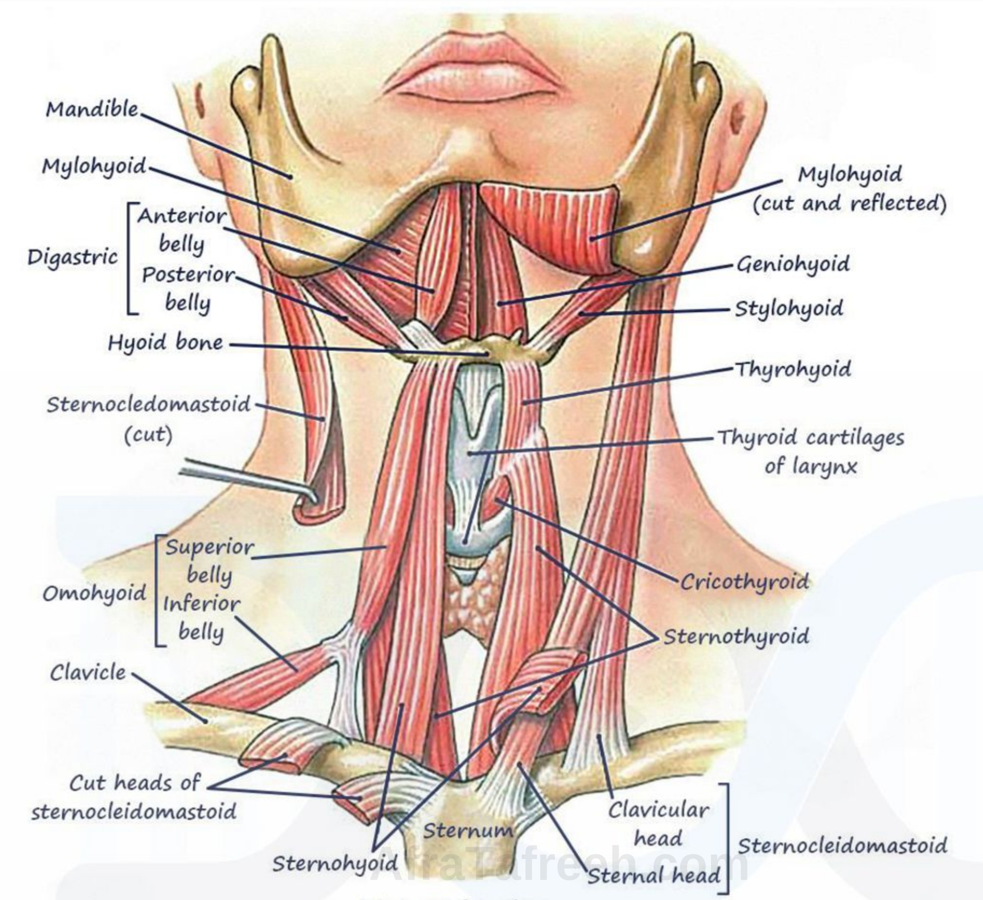
- Above vocal cord (Supraglottis) is by internal branch of internal branch of SLN Aka Internal laryngeal nerve
- Below vocal cord (subglottis) – RLN
- Vocal cord – both these nerves
  - Both RLN and SLN are branches of Vagus nerve.
  - Vagus is the mother nerve for laryngeal innervation
  - If the Vagus nerve is cut, the larynx is dead on that side.

Which side vocal cord paralysis is more common?

- The left side vocal cord paralysis is 4 times more common than right side. This is because of the longer course of left RLN (as it loops around arch of aorta in mediastinum)



Extrinsic muscles of larynx 00:24:37


Mandible
Mylohyoid
Digastric
Anterior belly
Posterior belly
Hyoid bone
Sternocledomastoid (cut)
Omohyoid
Superior belly
Inferior belly
Clavicle
Cut heads of sternocleidomastoid
Sternohyoid
Sternum
Mylohyoid (cut and reflected)
Geniohyoid
Stylohyoid
Thyrohyoid
Thyroid cartilages of larynx
Cricothyroid
Sternothyroid
Clavicular head
Sternal head
Sternocleidomastoid

(a) Anterior view

Fig: 2

- Elevators (suprahyoid)
- Above the hyoid bone - suprahyoid
- Mylohyoid
- Stylohyoid
- Geniohyoid
- Depressors(infrahyoid)
- Sternothyroid
- Sternohyoid
- Omohyoid

VOCAL CORDS PARALYSIS

- Normal/ neutral position of vocal cord is cadaveric or intermediate position.
- In the comfortable breathing state, the position of vocal cord is slight abduction.
- In a deep breathing state, position of vocal cord will be full abduction.

- Distance from midline of the VC
- 0 mm- median
- 1.5mm – paramedian
- 3.5mm- intermediate or cadaveric
- 7.0mm- slight abduction
- 9.5mm- full abduction

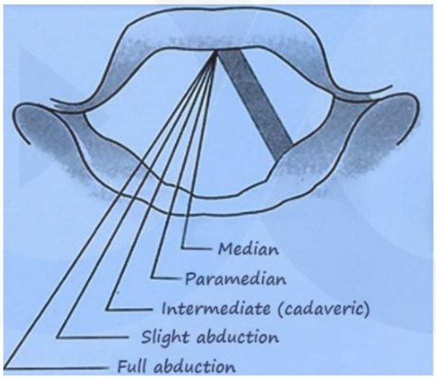

Median
Paramedian
Intermediate (cadaveric)
Slight abduction
Full abduction

Fig: 1

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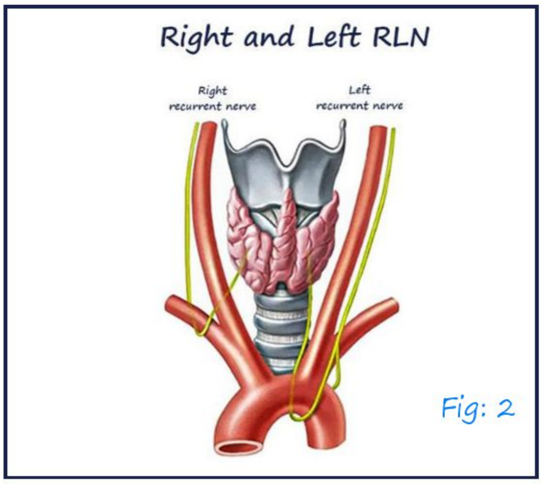
Right and Left RLN
Right recurrent nerve
Left recurrent nerve

Fig: 2

Relation with thyroid gland 00:07:23

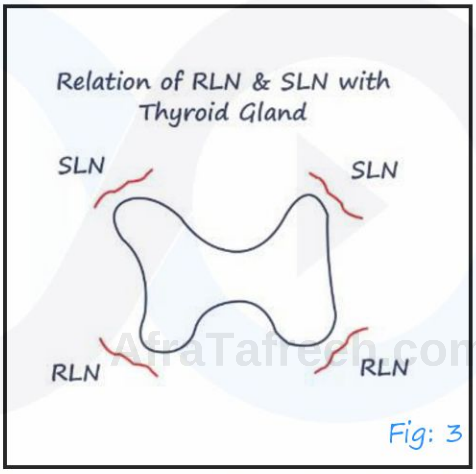
Relation of RLN & SLN with Thyroid Gland
SLN
SLN
RLN
RLN

Fig: 3

- Why vocal cords come in adducted position in RLN palsy?
- Two theories have been put forward to explain this

Wagner & Grossman hypothesis-

- Cricothyroid is the only muscle which is not paralyzed in RLN palsy. This is because cricothyroid muscle is supplied by the external branch superior laryngeal nerve). In RLN palsy, cricothyroid muscle brings vocal cord in the midline due to its adductor function

Semon's law-

- In RLN palsy, abductor fibers of nerve are more sensitive to injury as compared to adductor fibers so abductor fibers are first to be paralyzed.

Vocal cord palsy 00:13:09

Causes of vocal cord palsy

- Most common cause of unilateral VC palsy is idiopathic> carcinoma bronchus.
- Most common cause of bilateral VC palsy (RLN palsy) is thyroid surgery.
- Thyroid malignancy
- Esophageal malignancy
- Neck trauma and High vagal lesions
- Carcinoma of apex of right lung (Pancoast tumor) → right RLN palsy
- Aortic aneurysm → left RLN palsy
- Left atrial enlargement → left RLN palsy

Ortner syndrome/ cardio vocal syndrome

- Left Acromegaly causing left RLN palsy

Unilateral vocal cord palsy (RLN palsy) 00:22:09

- Cause: Diphtheria
- Mostly asymptomatic
- Treatment: conservative treatment

Bilateral vocal cord palsy 00:24:07

- They are of 2 types
  - Bilateral abductor palsy
  - Bilateral adductor palsy

Bilateral abductor palsy 00:24:40

- Bilateral vocal cord abduction is absent
- VCs lie in midline position and are paralyzed

Bilateral Abductor Palsy

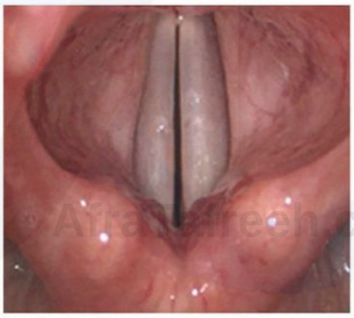

Fig: 4

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Causes-

- Idiopathic bilateral RLN palsy seen in children
- Bilateral RLN injury in thyroid surgery (MCQ)
- Only Cricothyroid muscle is working and it is an adductor, therefore both VC come to lie in median/ paramedian position
- C/C- respiratory distress with stridor but voice is normal
- (We breathe with open VC and speak with closed VC)
- It is an airway emergency.

Treatment:

- immediate treatment is tracheostomy. Then wait for 6months for spontaneous recovery (universal rule for all VC palsy).
- If no recovery seen after 6 months, then definitive treatment options will be as follows:
  - Treatment of choice is surgery called Type II thyroplasty/ Lateralization of vocal cord/ Suture Cordopexy

Type II thyroplasty=Lateralistation of Vocal Cord=Suture Cordopexy

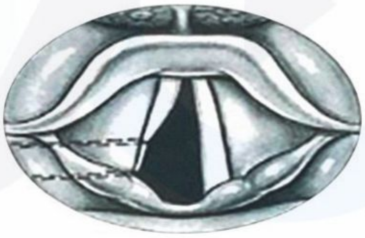
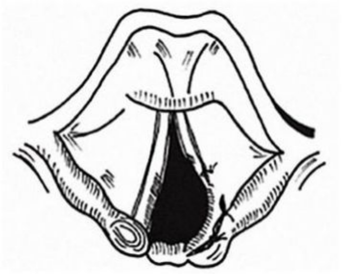


Fig: 5

  - Arytenoidectomy – it can be open surgical procedure (old) (Woodman's operation) or endoscopic (new) (CO2 laser assisted)

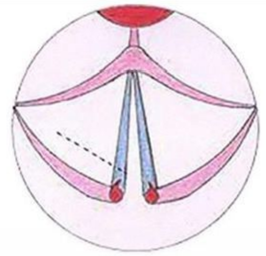


Arytenoidectomy

Fig: 6

  - Co2 laser cordectomy

- Kashima operation -it is separation of membranous and cartilaginous (arytenoid cartilage) part of vocal card with the CO2 laser



Kashima Operation

Fig: 7

- Nerve muscle implant.

Bilateral adductor palsy 00:40:08

- Adduction of both vocal cords absent
- VCs lie in open position and are paralyzed
- Cause- bilateral vagal palsy
- In BILATERAL Vagal palsy, no muscle is left working (RLN + SLN palsy= complete palsy). Vocal cord come in cadaveric position/ intermediate position (open vocal cord)

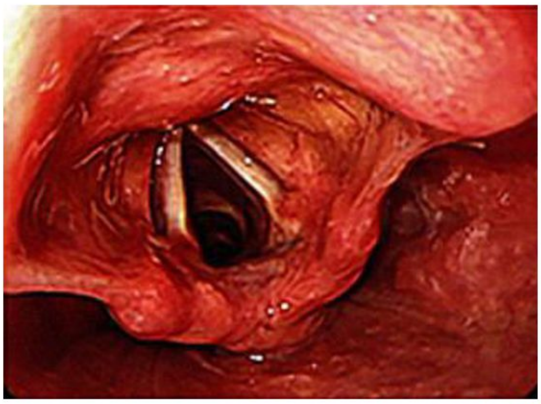


Fig: 8

- C/C- Aphonia and Aspiration (leads to recurrent pneumonia).
- There is no respiratory distress. So, It is not an emergency
- If no recovery seen after 6 months, then definitive treatment options will be as follows:
- Treatment of choice is surgery called TYPE I THYROPLASTY/Medialization of vocal cord. Make a window in thyroid cartilage and put the implant through a window that pushes vocal cord medially.

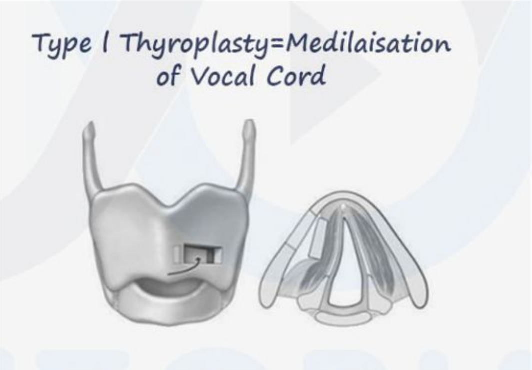


Fig: 9

- Teflon injection in the vocal cord – will swell up Vocal cord permanently and it will lead to medialization of vocal cord.

Superior laryngeal nerve (SLN) palsy 00:49:45

- Cause- thyroid surgery (upper pole of thyroid gland has relation with superior laryngeal nerve)
- SLN has 2 branches
- External branch which supplies Cricothyroid muscle which is the main tensor of vocal cords

- Internal branch which is sensory supply above vocal cords (supra glottis).

<table>
<tr><th colspan="2">SLN</th></tr>
<tr><td>External branch
↓</td><td>Internal branch
↓</td></tr>
<tr><td>Cricothyroid (main tensor)
↓</td><td>Sensory supply (above vocal cord)
↓</td></tr>
<tr><td>Poor quality of voice</td><td>Aspiration</td></tr>
</table>

- Therefore, in SLN palsy, patients have poor quality of voice and aspiration.

Examination

- Bowed down vocal cords. (Lack of tension)
- Skewed glottis (rotated glottis) in case of unilateral SLN palsy. (Other side of muscle is working therefore it will pull/ rotate the anterior commissure of glottis towards normal side)

Thyroplasty 00:55:56

- Type 1 – medialization of cord → done is adductor palsy
- Type 2 – lateralization of cord → done is abductor palsy
- Type 3 – shortening/ loosening → done in puberphonia
- Type 4 – lengthening/tightening → done is androphobia

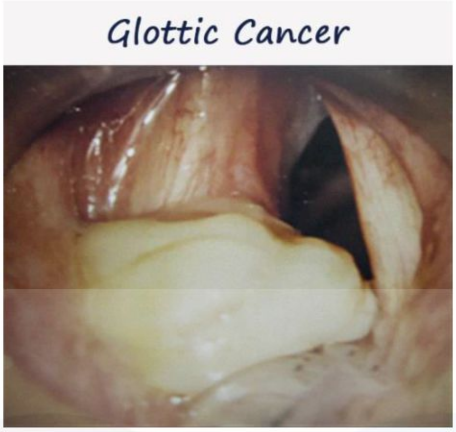
CANCER LARYNX

- This is ten times more common in males. (Because smoking is more common in males)
- Commonly seen in age 40-60 years.
- Most common histopathological type is squamous cell carcinoma (90%).
- Risk factors-
  - Smoking (tobacco) - benzopyrene.
  - Alcohol Synergistic effort of alcohol and smoking - 15 folds risk
  - Radiation exposure.

Types of cancer 00:02:05

- Three types of cancer:
  - Glottic cancer
  - Supraglottic cancer
  - Subglottic cancer

Glottic cancer 00:02:23

• It is most common type of laryngeal cancer. • It is cancer of true vocal cord. • Most common site is free edge and upper surface of anterior 2/3rd of vocal cord.) • C/c – hoarseness of voice is early feature, therefore it is diagnosed at early stages. • No neck node metastasis because vocal cords don't have lymphatics. Therefore, this cancer has good prognosis.	 Fig: 1

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Concept of trans glottic growth

- The glottis malignancy may involve supraglottis (grow upwards) or subglottis (grow downwards) in later stages of growth

Supragloticc cancer 00:06:40

- Supraglottis
  - epiglottis
  - aryepiglottic folds
  - false vocal cords
  - ventricle
  - saccule
- Most common site is epiglottis.
- It is almost a silent cancer to begin with.
- Later, Supraglottic cancer gives throat problems
- C/c –
  - Throat pain referred to ear
  - Feeling of lump in throat
  - Dysphagia
  - Hot potato or plummy voice.
  - S – supraglottic
  - S– silent cancer
  - S– secondaries in neck are common
- Metastases in level II, III neck nodes are common (secondaries)

Subglottic cancer 00:12:40

- This is least common type.
- Subglottisis the empty space inside cricoid ring.
- C/c –biphasic stridor

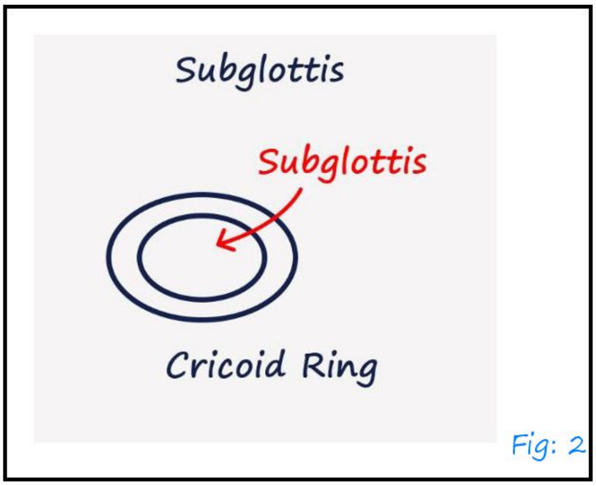

Fig: 2

TNM staging of cancer larynx 00:13:48

Supraglottis	
T1	Tumor limited to one subsite for supraglottis with normal vocal cord ability
T2	Tumor invades mucosa of more than one adjacent subsite of supraglottis or glottis or region outside the supraglottis (e.g., Mucosa of base of tongue, vallecula, medial wall or pyriform sinus) without fixation of the larynx)
T3	Tumor limited to larynx with vocal cord fixation or invades any of the following; post cricoid are, pre-epiglottic tissue, paraglottic space, or minor thyroid cartilage erosion (e.g., Inner cortex)
T4	Tumor invades through the thyroid cartilage or invades tissues beyond the larynx (e.g., Trach, soft tissues of neck including deep exoticism muscle of the tongue, strap muscles thyroid, or esophagus)
T4b	Tumor invades prevertebral space encases carotids artery, or invades mediastinal structures

Glottis	
	Tumor limited to the vocal cords(s) may involve anterior or posterior commissure) with normal mobility
	Tumor limited to one vocal cord
	Tumor involves both vocal cords
	Tumor extends to supraglottis or subglottis, or with impaired vocal cord mobility
	Tumor limited to the larynx with vocal cord fixation or invades paraglottic space, or Monir thyroid cartilage erosion (e.g., Inner cortex)
	Tumor invades through the thyroid cartilage or invades tissue, beyond the larynx (e.g., trachea soft tissue of neck including deep extrinsic muscle of the tongue, strap muscle, thyroid or esophagus)
	Tumor invades prevertebral space encase carotid artery, or invades mediastinal structures
Subglottis	
	Tumor extends to the vocal cords(s) with normal or impaired mobility
	Tumor limited to the subglottis
	Tumor limited to larynx with vocal cord fixation
	Tumor invades cricoid or thyroid cartilage or invades beyond the larynx (e.g., Trachea, soft tissues of neck including deep extrinsic muscles or the tongues, strap muscle, thyroid or esophagus)

Reginal lymph Nodes (N)	
NX	Reginal lymph nodes cannot be assessed
NO	No regional lymph nodes metastasis
N1	Metastasis in single ipsilateral lymph node, 3 cm or less in greatest dimension
N2	Metastasis in single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension, or multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimeson, or in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension
N2a	Metastasis in single ipsilaterally nodes more than 3cm but not more than 6 cm in greatest dimensions
N2b	Metastasis in multiple ipsilateral lymph node's none more than 6 cm in greatest dimeson
N2c	Metastasis in bilateral contralateral lymph nodes, none more than 6 cm in greatest dimeson
N3	Metastatic in lymph node, more than 6 cm in greatest dimension
Distant Metastasis (M)	
	Distant metastasis cannot be assessed
	No distant metastasis
	Distant metastasis

A simplified way to memorise laryngeal cancer staging (for MCQ purposes)

Stage		Examples:
T1:	only one named structure involved	Eg: Tumor involving epiglottis or vocal cord
T2	more than one named structure involved	Eg: tumor involving epiglottis + aryepiglottic folds
T3	Vocal cord is fixed or immobile/ or there is involvement of pre-epiglottic space or paraglottic space Cause of VC fixation is infiltration of thyro-arytenoid muscle by cancer cells	Eg: If MCQ says Tumor has caused fixation of right vocal cord or tumor has invaded into a space
T4	invasion of thyroid cartilage or extra laryngeal extension into neck structures	Eg: tumor invading the thyroid gland

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Treatment

T1 Tumor

- Radiotherapy.
- Now-a-days, for T1 glottic cancer laser surgery is better treatment than radiotherapy.

T2 Tumor

- Radiotherapy
  - 2nd best option for T2 tumors is partial laryngectomy if lungs are normal. Partial laryngectomy is of 2 types
  - Horizontal Partial Laryngectomy (HPL) is done for T2 supraglottic cancer. when Both Vocal cords are normal
  - Vertical (VPL) Partial Laryngectomy is done for T2 glottic cancer when Growth involving one hemi larynx

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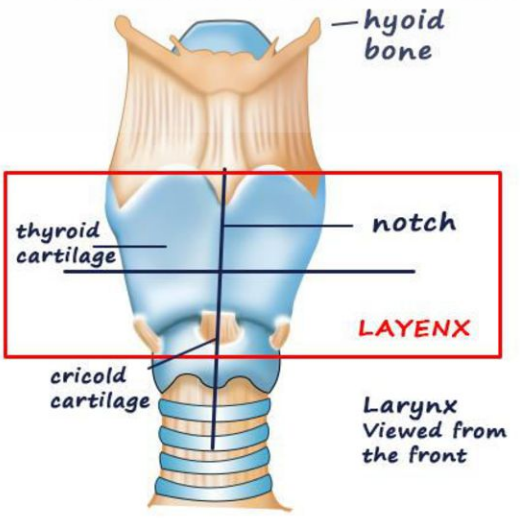
hyoid bone
thyroid cartilage
notch
LAYENX
cricold cartilage
Larynx Viewed from the front

Partial Layrngectomy

Fig: 3

Partial laryngectomy PL	
Horizontal partial laryngectomy HPL ↓	Vertical partial laryngectomy VPL ↓
T2 supraglottic cancer	T2 glottic cancer

T3 & T4 Tumors

- Treatment of choice is total laryngectomy using Gluck Sorenson Incision +/– radical neck dissection followed by radiotherapy.

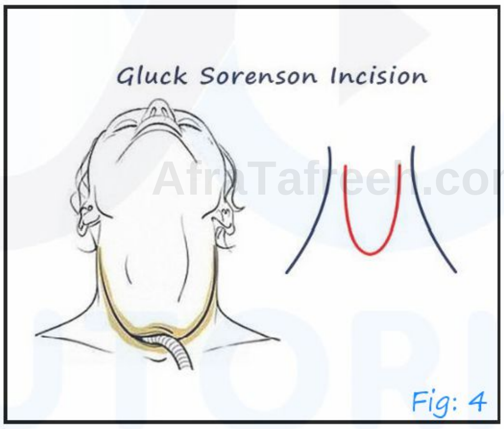

Fig: 4

- Gluck Sorenson incision: raise a flap and make larynx free from all its attachment, and transecting it from trachea also to remove the larynx. Then, suture the edges of trachea to the skin. This will make a permanent tracheostomy. Hence, after total laryngectomy, patient has permanent tracheostomy.
- 2nd best option for T3 and T4 tumors is concurrent chemoradiation if patient is unwilling for unfit for surgery.

Summary

T1	involving only 1 named structure	Radiotherapy/Laser Surgery for T! glottic
T2	more than 1 named structure involved	Radiotherapy > partial laryngectomy
T3 T4	VC is fixed or at least 1 space is involved frank invasion of thyroid cartilage or invasion of any neck structure	Total laryngectomy + radiotherapy >chemoradiation

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Vocal rehabilitation after total laryngectomy 00:30:18

3 methods

- Esophageal voice
- Swallow lot of air and release air in the form of puffs
- Vibrating part is pharyngo-esophageal segment.
- It is difficult technique to learn.

Electrolarynx or artificial larynx

- It is battery operated hand held external mechanical vibrator.
- Oropharyngeal structure vibrates and produce sound

Electrolarynx=
Artificial Larynx

Fig: 5

Tracheo esophageal Puncture device (TEP Device)

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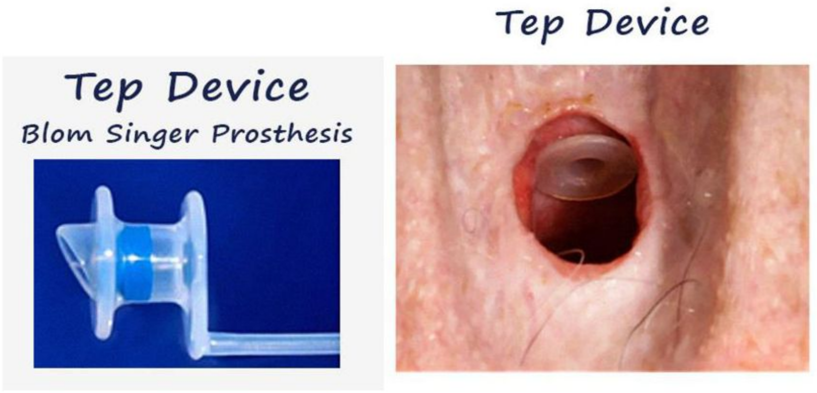
- Best option
- Unidirectional internal valve like device which is surgically placed between trachea and esophagus.
- Create a fistula between trachea and esophagus and place this device
- Air from trachea will go to esophagus
- Vibrating segment is mucosa of pharyngeo-esophageal segment
- Examples:
  - Blom singer prosthesis.
  - Provox device.
  - Panje device



Tep Device

Blom Singer Prosthesis

Tep Device

Fig: 6

Clinical vignette

- Q1) CT scan of neck of a patient of carcinoma larynx has been found to have the involvement of epiglottis, right ventricular band, right true vocal cord and invading into pre-epiglottic space. What is the ideal treatment of this patient?

  - Radiotherapy

  - Total laryngectomy + radiotherapy

  - Chemotherapy

  - Chemoradiation

- Answer: B, it is stage T3 due to involvement of pre-epiglottic space, hence total laryngectomy followed by radiotherapy is the treatment.

NECK NODES AND RADICAL NECK DISSECTIONS

Level of neck nodes 00:00:10

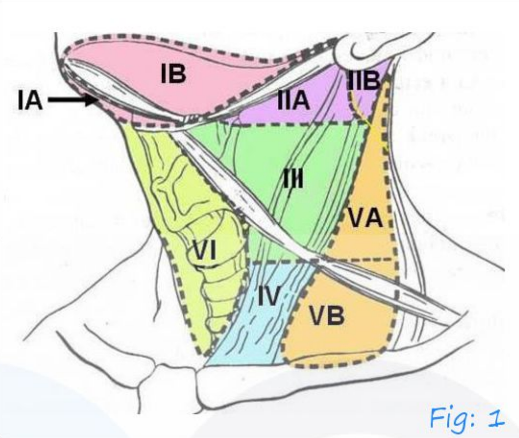


Fig: 1

Level I A-	Submental neck nodes
Level I B –	Submandibular neck nodes
Level II	Upper deep cervical
Level III -	Middle deep cervical
Level IV	Lower deep cervical
Level V	Posterior triangular (Supraclavicular)
Level VI	Anterior compartment (peritracheal).
Level VII	Mediastinal lymph nodes

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Line of separation of neck nodes

- Level II, III, IV lie deep to upper 1/3rd, middle 1/3rd and lower 1/3rd of sternocleidomastoid muscle

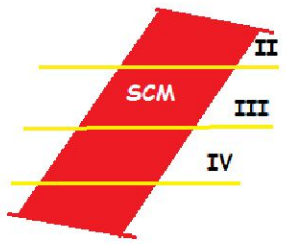

Fig: 2

Radical neck dissection (RND) 00:05:24

- This surgery done for metastasis (secondary) neck nodes.

List of structures removed in RND are as follows MCQ

- Level I to level V neck nodes.
- Sternocleidomastoid muscle. (M) (majority of Lymph nodes lie below it)
- Internal jugular vein (V)
- Accessory spinal nerve. (A)
- Omohyoid muscle.
- Submandibular gland.
- Tail of parotid gland.

Modified radical neck dissection (MRND) 00:010:09

- This is RND only but some structures are preserved in this surgery
- This surgery is of 3 types based on structures preserved during the procedure.

TYPE I MRND	preserve accessory spinal nerve (A)
TYPE II MRND	preserve accessory spinal nerve and internal jugular vein (A+V)

TYPE III MRND	preserve accessory spinal nerve, internal jugular vein, sternocleidomastoid muscle (A+V+M)

TRACHEOSTOMY

Skin incision in emergency tracheostomy

- Vertical incision
- Used in emergency tracheostomy
- It makes the surgery quick
- It gives bad scar

Skin inscision

↓

retract stroap muscles of neck

↓

retracting thyroid insthus upwards

↓

Expose Tracheal & give tracheal incision

Indications of tracheostomy

- Respiratory obstruction above the level of trachea for airway management
- For prolonged mechanical ventilation (intubation) >7days.
- For bronchial toilet. E.g. –COPD patient in coma.
- To prevent aspiration (the cuff of tube helps to prevent aspiration)
- In oropharyngeal surgery to prevent aspiration and maintain airway.
- In maxillofacial trauma to prevent aspiration and maintain airway

- Tracheostomy reduces dead space by 50%.

- Tracheostomy is a temporary procedure except after total laryngectomy.

Decanulation

- It is final removal of tracheostomy tube once its purpose is over.
- It is difficult process in children (as children get dependent on tracheostomy). Therefore, one should down size the tube in the children and don't remove it directly. (e.g., 6 to 5 to-4 then-half closed – and then remove)

Steps of tracheostomy

Skin inscision

↓

retract stroap muscles of neck

↓

Retracting thyroid insthus upwards

↓

Expose Tracheal & give tracheal incision

Tracheal Incision

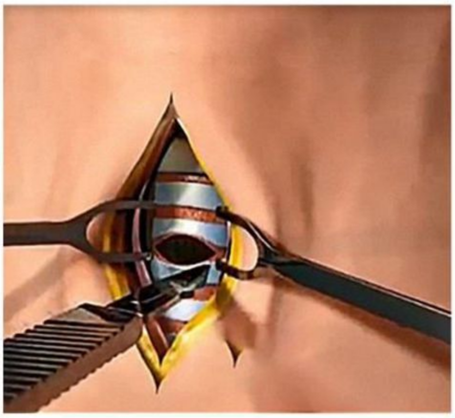

Fig: 1

3 types of tracheostomies depending on site of tracheal incision

Mid tracheostomy

- Most common site of tracheostomy.
- It is done at the level of 2nd and 3rd tracheal ring.
- We avoid first tracheal ring to prevent damage to larynx. (Which can lead to subglottic stenosis)

High tracheostomy

- It is done at first and second ring.
- It is done in cancer larynx. (MCQ)
- This is done so that adequate length of trachea is available after total laryngectomy to be sutured to the skin of the neck to make permanent tracheostome.

Low tracheostomy

- It is done at 3rd and 4th or 4th and 5th tracheal ring.
- Indication is tracheal stenosis in upper part

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Instruments 00:07:50

- Cricoid hook

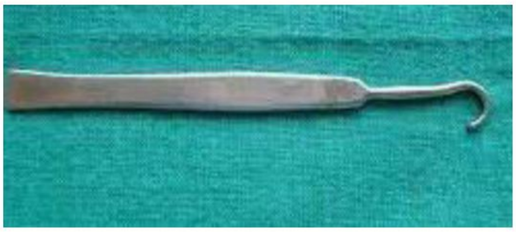


Fig: 2

- Stabalise the cricoid with the cricoid hook and can incise the trachea easily

Tracheal dilator

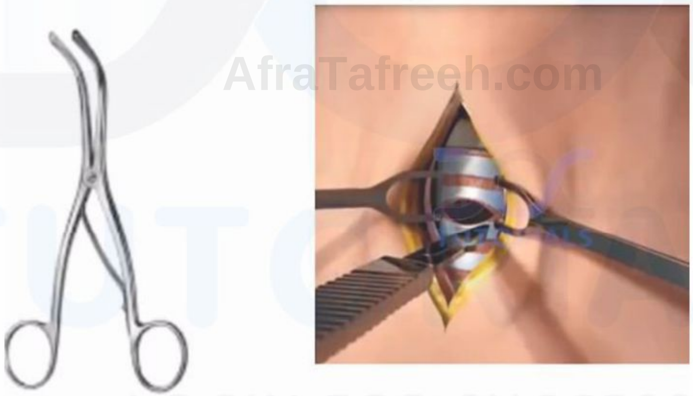


Fig: 3

- Tracheostomy reduces dead space by 50%
- Tracheostomy is a temporary procedure except after total laryngectomy.

What is decanualtion?

- It is the final removal of tracheostomy tube once its purpose is over
- It is a difficult process in children

Tracheostomy tube

Care of tracheostomy tube

- Suction of tracheostomy tube should be done on regular basis
- What is the ideal time of first tube change?
- 48-72 hrs
- If the tube is blocked, remove the tube immediately

Types of tracheostomy tube 00:19:40

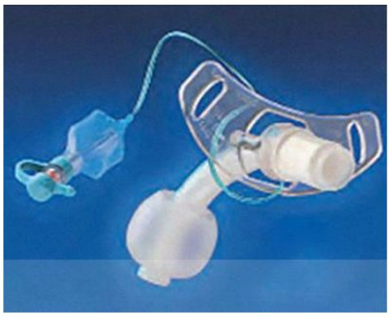
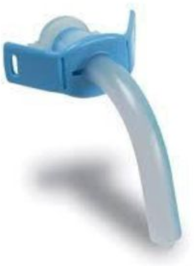
- Portex PVC cuffed tracheostomy tube-
- Most commonly used
- The cuff helps to decrease aspiration, but cuff can cause tracheomalacia (weakening of tracheal wall)

How to decreases chances of tracheomalacia due to cuff?

- Use high-volume, low-pressure cuff (less pressure on walls, therefore less chances to cause tracheomalacia)
- Intermittent deflation of cuff for 5min every 2hours.

Portex PVC uncuffed tracheostomy tube

- More commonly used in children

 Portex PVC cuffed tracheostomy tube	 Portex PVC uncuffed tracheostomy tube Fig: 4

Metallic tracheostomy tube

- Mostly made of German silver.
- They are double lumen tubes -outer and inner tubes.
- Examples of metallic tube
  - Chevalier Jackson tube- inner tube is longer tube.
  - To clean the tube, only inner tube is removed cleaned and replaced. Outer tube is left as such.
  - This is good option for homecare.
  - Fullers tube- outer tube is biflanged, inner tube is fenestrated.
  - Air from the fenestration goes up and helps the patient to speak

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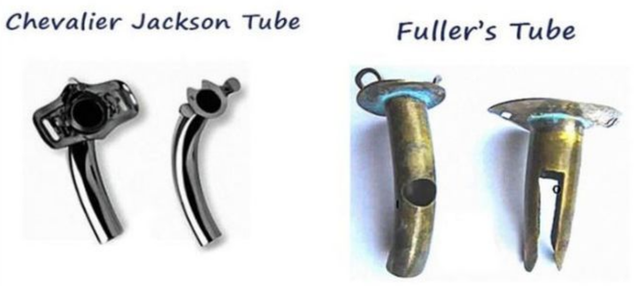

Fig: 5

Complications of tracheostomy 00:28:57

- Immediate complications of tracheostomy
- Hemorrhage (it is the most common).
- Surgical emphysema (MCQ)- air in the subcutaneous planes. Some air will leak from the tracheostomy tube and collect into the subcutaneous planes
- Apnea- it is due to CO2 washout. (MCQ)-
- Pneumothorax- due to damage of apical pleura, it is more common in children because of high pleural index.
- Injury to other structures like recurrent laryngeal nerve (close to trachea), thyroid isthmus etc.
- Loss of voice (it is a sequelae of tracheostomy)

Late complication

- Tube displacement - this is more common in children. So, we pass silk suture into edges of trachea and secure sutures to the skin.
- Even if the tube gets displaced, with the help of sutures, the trachea can be pulled back to place and the tube can be re-inserted

- Tube blockage- this is due to improper suction. In this case, remove the tube immediately and put new tube. (MCQ)
- Infection– surrounding area and skin
- Subglottic stenosis
- Difficulty in decanulation.
- Tracheocutaneous fistula- if the tracheostomy hole doesn't close

Percutaneous dilatational tracheostomy

- It is a bed side procedure
- Percutaneous dilatation tracheostomy kit

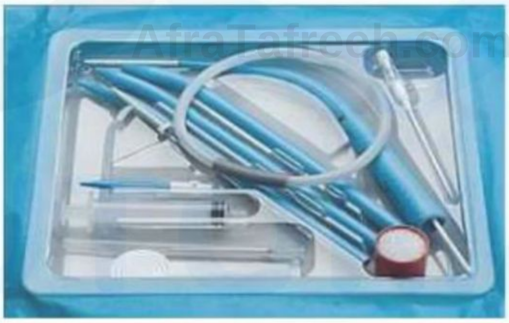

Fig: 6

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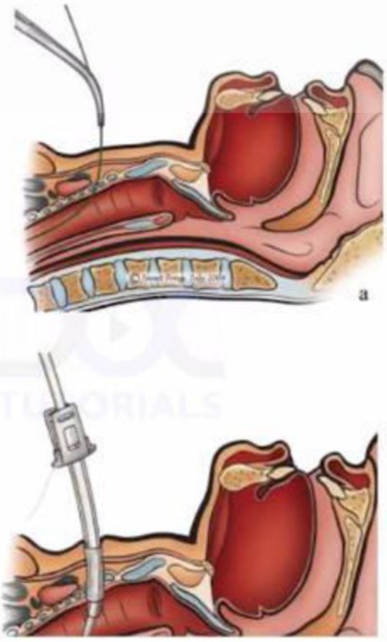


Fig: 7

AIRWAY FOREIGN BODY

- More common in children (1 – 4 years)
- Peanut is the most common foreign body
- Airway foreign body aspiration
  - Larynx
  - Trachea – audible sound and palpatory thud
  - Bronchi – right bronchus (because it's wider and in line with trachea)

Triad

- Sudden bout of cough
- Wheezing
- Diminished air entry into lungs

Radiological findings

- Radio opaque foreign body

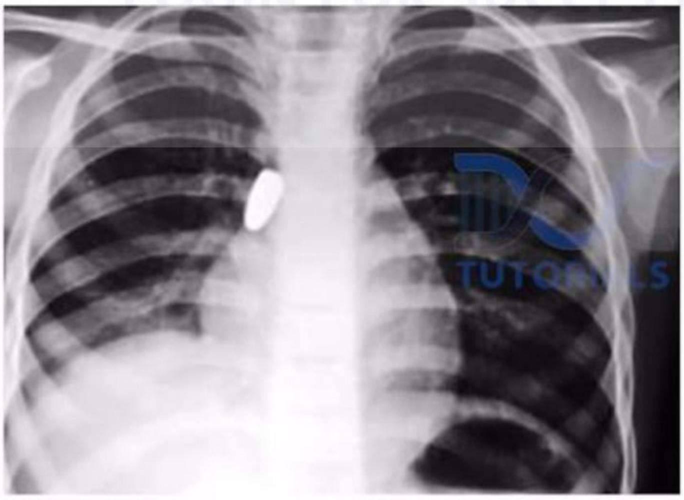


Fig: 1

DOC TUTORIALS LOGIN FOR SUCCESS

- Segmental or lobar collapse

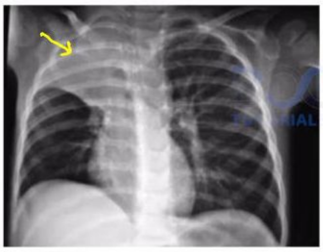


Fig: 2

- Hyperinflation of lung

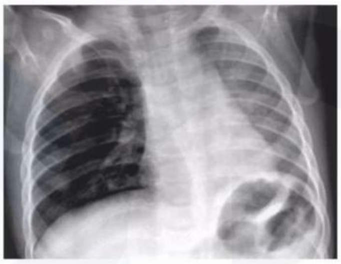


Fig: 3

- X-ray chest (pa view) is best x-ray view for bronchial foreign bodies

Management of bronchial foreign body 00:08:25

- Rigid bronchoscopy

RIGID BRONCHOSCOPY

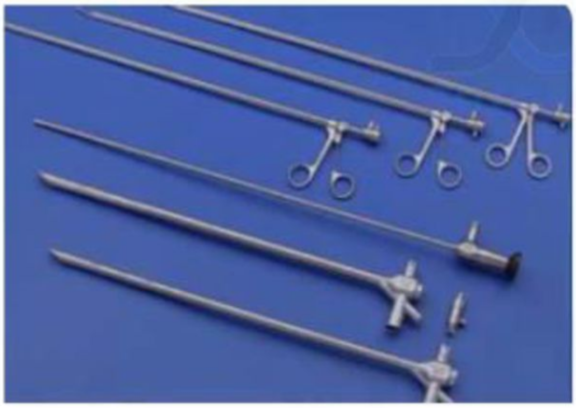
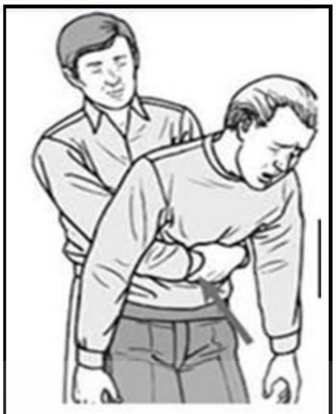


Fig: 4

Laryngeal foreign body 00:08:42

• A person while eating something suddenly gets choking and aphonia – This is because of the food particle stuck as laryngeal foreign body – It leads to airway emergency – Immediate treatment- Heimlich's maneuver- pressure is given over the epigastrium in backward & upward direction.	 Fig: 5

MISCELLANEOUS DISEASES OF LARYNX

Tuberculosis of Larynx

- It is secondary to pulmonary TB.
- It is a painful condition (generally TB is painless, but TB larynx is painful)
- Earliest lesion – congestion of vocal cords in interarytenoid area (posterior)
- Late signs - mouse nibbled appearance (multiple ulcers) of vocal cords
- Turban epiglottis. (Red and bulky)
- C/c: painful phonation. (When multiple ulcers touch)
- Investigation- direct laryngoscopy + biopsy
- Treatment- Anti tubercular therapy

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Lupus larynx (Atypical TB) 00:04:20

- There is no pulmonary TB.
- It is a painless disease
- It involves anterior part of larynx in early stages (epiglottis is most common site)

Tuberculosis of larynx	Lupus larynx (atypical tb)
secondary to pulmonary TB	There is no pulmonary TB.
painful condition	painless disease
It involves posterior part of larynx in early stages	It involves anterior part of larynx in early stages (epiglottis is most common site)

Leprosy 00:05:55

- Most common site of involvement is supraglottic

Wegener's granulomatosis & Scleroma of larynx 00:06:17

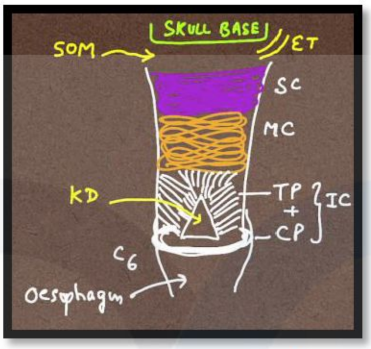
- The Most common site of laryngeal involvement in these disorders is subglottic which can lead to acquired subglottic stenosis.
- These are Chronic inflammatory conditions which Can lead to fibrosis and scaring, which leads to stenosis

Atrophic laryngitis/ laryngitis sicca 00:07:24

- It is similar to atrophic rhinitis.
  It is More common in females
- Examination- atrophy of laryngeal mucosa & crust formation
- C/c- dry cough
- Treatment-
- Micro laryngeal surgery to remove crusts.
- Glycerol laryngeal spray.

PHARYNX – APPLIED ANATOMY

Anatomy and Parts of Pharynx

Pharynx is a fibro-muscular tube. It extends from skull base to C6 vertebrae It has 3 muscles (see image) 1. Superior constrictor muscle (SC) 2. Middle constrictor muscle (MC) 3. Inferior constrictor (IC) muscle – it has 2 parts - Oblique fibers- Thyropharyngeal (TP) - Circular fibers- Cricopharyngeal. (CP)	 SKULL BASE SOM ET SC MC KD TP + CP IC C6 Oesophagus Fig: 1

Killian's Dehiscence (KD)

- It is a triangular area in Inferior constrictor muscle between the fibres of thyropharyngeus and cricopharyngeus. (See image above) (MCQ)
- This area lacks muscular support. Therefore, it is a weak area of pharynx.

- Clinical Anatomy
  1. It is the site of the formation of Zenker's diverticulum (=pharyngeal pouch).
  2. It is a possible site of perforation during rigid endoscopy.

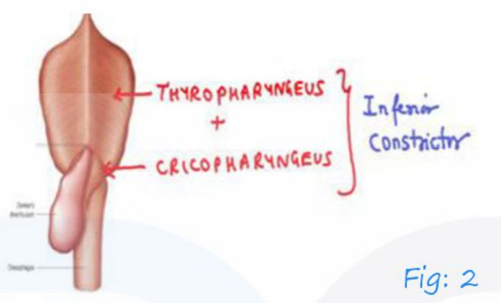


Fig: 2

Sinus Of Morgagni (SOM)

- It is the space between the skull base and upper border of superior constrictor muscle. (See first image)
- Eustachian tube & tensor veli palatini muscle (tensor palati muscle) passes through sinus of Morgagni. (MCQ)
- The most common site of impaction of foreign body in digestive tract is cricopharyngeal sphincter (level of C6).

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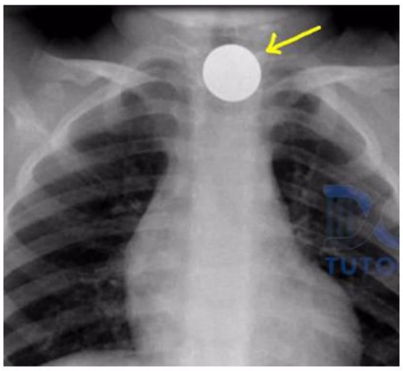


Fig: 3

Cut section of trachea and oesophagus

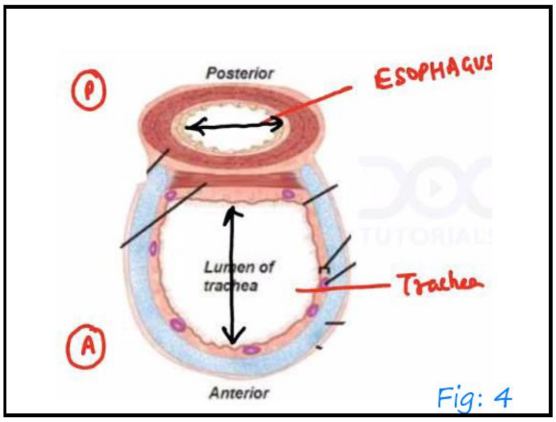
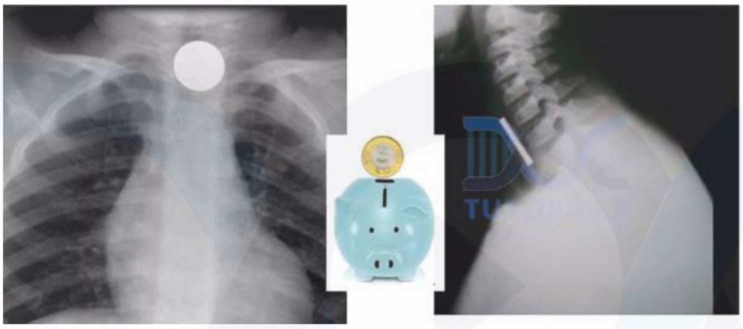
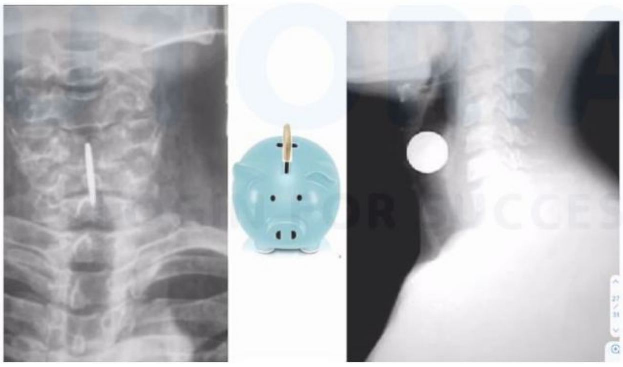

P
Posterior
ESOPHAGUS
Lumen of trachea
Trachea
A
Anterior

Fig: 4



Coin in oesophagus

Fig: 5

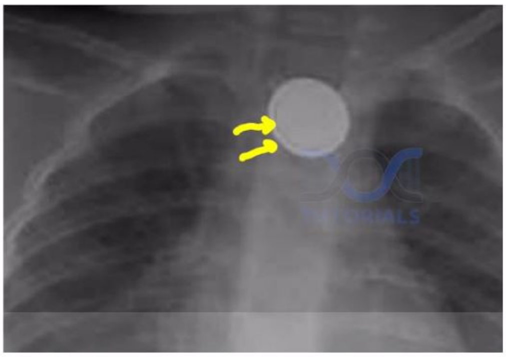


Coin trachea

Fig: 6

- Full view of coin in AP view → oesophagus
- Three F's
  - Full view of coin
  - Front Xray (AP view)
  - Food passage (oesophagus)

- Disc battery in oesophagus is an emergency situation.



(double ring shadow present)

Fig: 7

- Double ring shadow is present
- They can release alkali and hence are dangerous, which can cause oesophageal perforation. Therefore, the treatment is urgent removal.

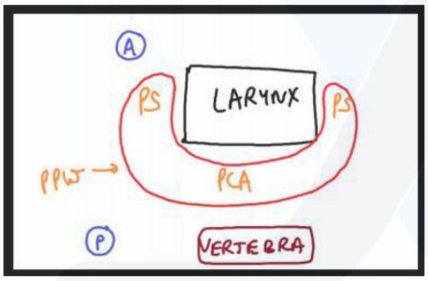
Pharynx has 3 parts-

1. Nasopharynx.
2. Oropharynx.
3. Laryngopharynx.

LARYNGOPHARYNX

Laryngopharynx

- It is also called HYPOPHARYNX.
- Hypopharynx has 3parts
  1. Pyriform sinus (PS). –right and left
  2. Post cricoid area (PCA).
  3. Posterior pharyngeal wall (PPW).


A
PS
LARYNX
PS
PPW →
PCA
P
VERTEBRA

Hypopharynx

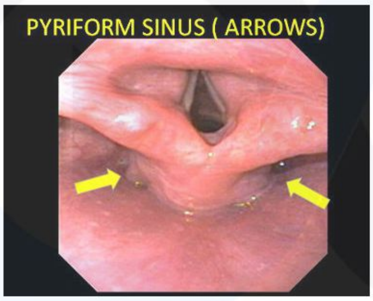

PYRIFORM SINUS (ARROWS)

Fig: 1

Sensory supply

- Internal branch of the superior laryngeal nerve, also called the internal laryngeal nerve, gives sensory supply to Supraglottic and pyriform sinus.
- Most common site of hypopharyngeal malignancy is PYRIFORM SINUS.

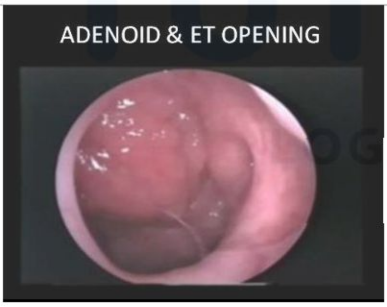
Laryngeal Crepitus

- It is a clicking sensation felt when the larynx is moved over cervical vertebrae. This is a normal examination finding in normal people.
- It is absent in
  - Post cricoid carcinoma
  - Retropharyngeal abscess
  - Prevertebral abscess
  - Laryngeal fractures
- Absence of laryngeal crepitus is called MOURE'S SIGN.

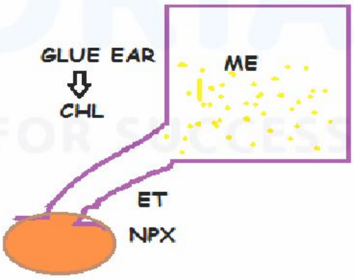
ADENOIDS

Nasopharynx

- To put it simply, the empty space behind the nose is Nasopharynx.
- It has 2 important landmarks.
- Eustachian tube opening (ET) (two)
- Adenoid tissue (single midline mass) (more prominent in children)
- Eustachian tube connect the middle ear to nasopharynx; therefore, nasopharyngeal diseases can lead to middle ear diseases for example GLUE EAR (serous otitis media) which leads to conductive hearing loss (CHL).



Normal picture



ET blockage

Fig: 1

Three topics in nasopharynx-

- Adenoid
- Angiofibroma
- Nasopharyngeal carcinoma.
- Thornwaldt disease

Adenoid

- It is also called NASOPHARYNGEAL TONSIL. (Tonsil – it is a general word which means any collection of lymphoid tissue in pharynx)
- Site- in Nasopharynx lying at the junction of roof and posterior wall of nasopharynx.
- It is ill defined lymphoid tissue in nasopharynx. It has

  - No CAPSULE.
  - NO CRYPTS.
  - NO DEFINITE BLOOD SUPPLY.
- It feels irregular on palpation.
- This is called "BAG OF WORMS FEEL". (Viva Question)
- Adenoid is present at birth; it increases in size up to 6 years of age. It starts decreasing in size at puberty and it disappears by 20 years of age.

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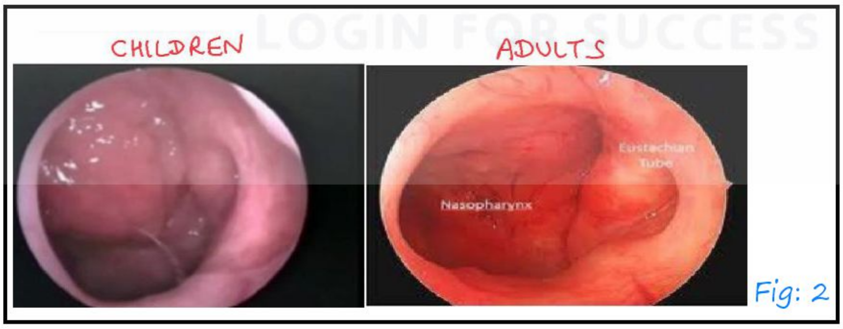


Fig: 2

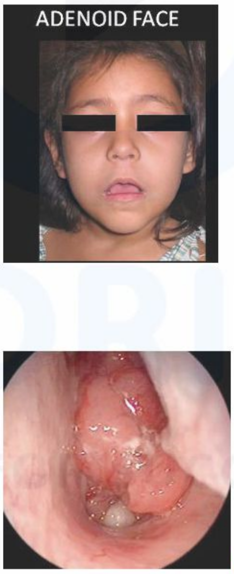
- See the image above- Normal Endoscopy picture

Adenoid hypertrophy 00:11:00

- Adenoid hypertrophy is a disease of school age children.
- It is more than physiological enlargement of adenoid.
- It is due to recurrent upper respiratory infection

Clinical picture

- The child is mouth breather with history of recurrent upper respiratory infection (URI).

Patient has a typical facial appearance called Adenoid face. It has following features: i. Open mouth. (Mouth breather) ii. Pinched nose iii. High arched palate Malocclusion of teeth.	 Fig: 3 • See the second picture, adenoid is enlarged and is blocking the Choana (**Posterior** opening of nasal cavity) • VIVA question

- This patient can have-
- RHINOLALIA CLAUSA (Hypo nasality of voice)
- Glue ear features – conductive hearing loss (mostly bilateral)
- Investigations- X ray soft tissue Nasopharynx lateral view

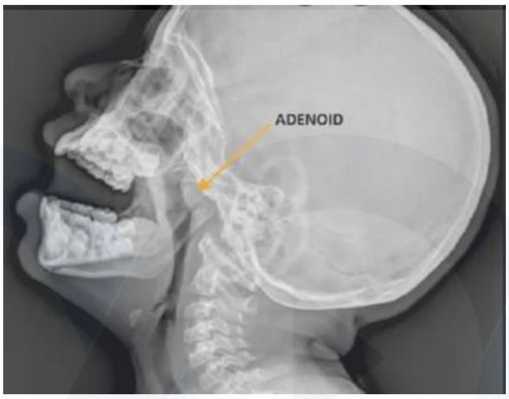


Fig: 4

Treatment

- Surgery: Adenoidectomy under General anaesthesia
- Always palpate adenoid before removal. To confirm the diagnosis and to rule out any artery passing over it. VIVA question
- Position of patient during surgery- ROSE POSITION
- Extension of neck on chest.
- Extension of head on neck.

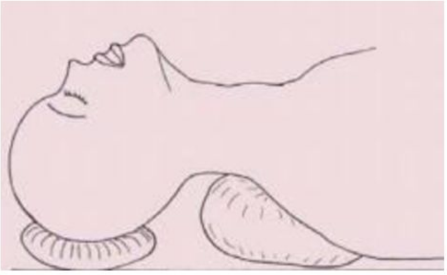


Fig: 5

- Over extension of neck can lead to atlanto-axial subluxation (C1-C2). This is called GRISEL SYNDROME. MCQ

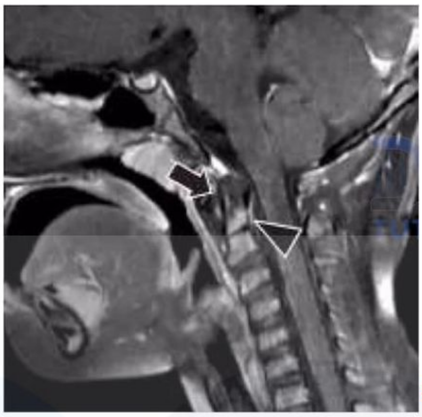


Fig: 6

- Same position is used for tonsillectomy also.

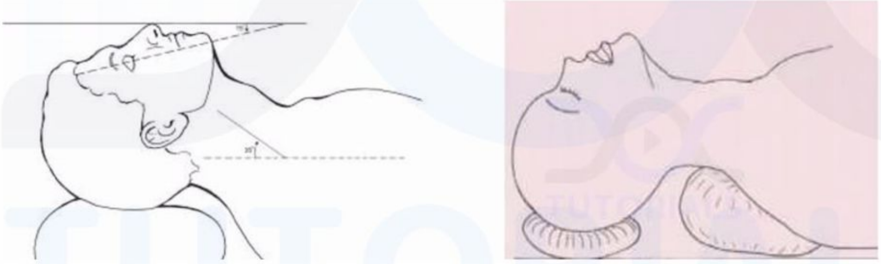
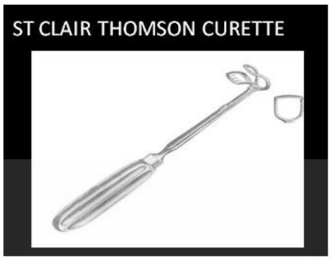


Fig: 7

- Boyce position was used in direct laryngoscopy
- Boyce position is flexion of neck on the chest and extension of head on neck

Methods of adenoidectomy-

Conventional method	
• Curettage. By using **ST. CLAIR** THOMSON ADENOID CURETTE. • It is a blind procedure and hence chances of **hemorrhage** and other complications may be present. • NEW METHODS OF SURGERY • COBLATION- controlled ablation, • SUCTION DIATHERMY. • MICRODEBRIDER. • These 3 are ENDOSCOPIC guided methods hence there are less chances of bleeding and other complications	 Fig: 8 The curette is held in Dagger holding fashion

- It is also other wise known as cold ablatio. This techinque ulitiese a filed of plams. Or ionded soidium locueusle, ot ablate tissue, the heat gernarted vaties form 40-80 degreees centrigrad,e mscuh lower thatn that of eactro cuatery. The major advantage of this procedure is reduced bleeding and reduced psot operative pain

Fig: 9

ANGIOFIBROMA

Angiofibroma

- Angiofibroma is the most common benign tumor of nasopharynx.
- Site of origin is the superior margin of sphenopalatine foramen.
- This is a tumor seen in young, adolescent boys (12-14 years)
- This tumor is highly vascular. The blood vessels of this tumor do not have muscular layers. Therefore, if once cut, they do not contract or retract. So, it always presents with profuse epistaxis and biopsy is contraindicated for this tumor.
- It is a hormone sensitive tumor, therefore preoperative Estrogen/ or Flutamide shrinks the tumor.
- Angiofibroma is a locally invasive tumor. It can extend into
  a. Nose, sinuses (Nasal Mass & Epistaxis)
  b. Cheek → the tumor grows into the pterygopalatine fossa behind the maxilla and then it enters the infratemporal fossa to present as cheek swelling (see image). In its expansion into pterygopalatine fossa, it pushes the posterior wall of maxilla forwards. This finding on radiology is called Hollman Miller or Antral sign. MCQ

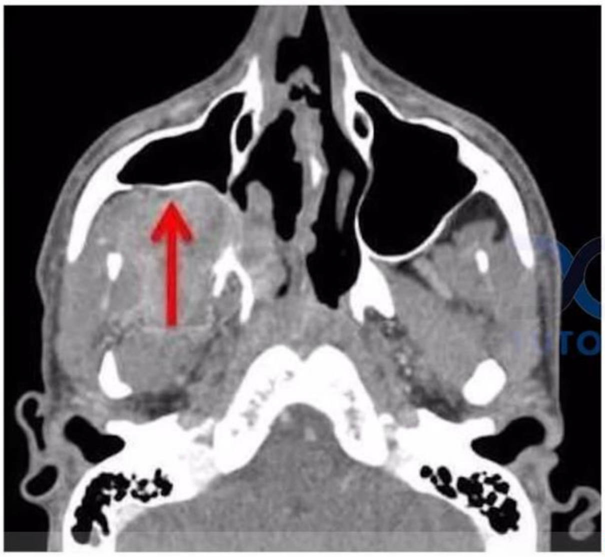
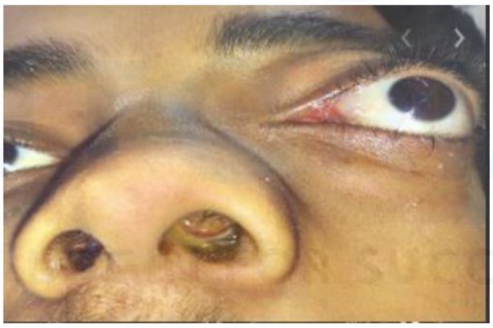


Fig: 1

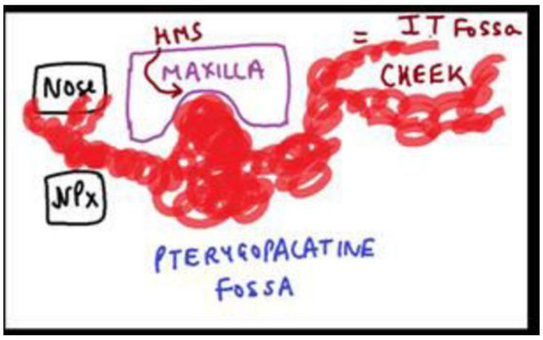
c. Orbit – orbital involvement will lead to proptosis, which is called FROG FACE DEFORMITY.

d. Brain (middle cranial fossa, anterior cranial fossa)

Cheek extension



Frog Face Deformity Fig: 2


HMS
MAXILLA
= IT Fossa
CHEEK
Nose
NPx
PTERYGOPALATINE FOSSA

Hollman Miller Sign = Antral Sign Fig: 3

Clinical picture-

- 12–14-year-old boy with nasal mass and profuse epistaxis presenting with other symptoms like
- Nasal substruction.
- Hypo nasality of voice.
- Glue year causing Conductive hearing loss.

Investigation-

1. CECT (contrast enhanced CT) will show HOLLMAN MILLER SIGN (it is also called ANTRAL SIGN). It is anterior bowing of the posterior wall of maxilla.

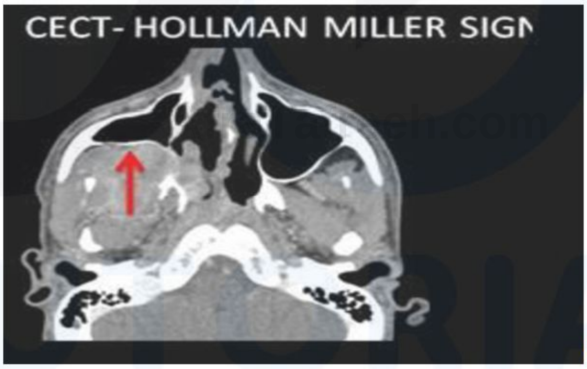


Fig: 4

2. Angiography - maxillary artery is the most common blood supply of this tumor. Preoperative embolization will reduce blood loss during surgery. Embolization is done only 24- 48 hrs before surgery. If surgery is delayed further after embolization, the collaterals will develop.

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CECT (Contrast enhanced)

- Hollman miller sign = antral sign
- It is anterior bowing of posterior wall of maxilla

Tumour Staging systems for Angiofibroma

1. Fisch staging
2. Radkowski staging

Angiofibroma staging (FISCH)

Fisch Staging Classification

- Done for prognosis and therapeutic approaches
- Stage I: Tumor limited to the nasal cavity
- Stage II: Tumor extension into the pterygopalatine fossa, or maxillary, sphenoid or ethmoid sinuses.
- Stage IIIa: Tumor extension into the orbit or infratemporal fossa without intracranial involvement.
- Stage IIIb: Stage IIIa with extradural (parasailer) intracranial involvement
- Stage IVa: Intradural without cavernous sinus, pituitary, or optic chiasm involvement
- Stage IVb: Involvement of the cavernous sinus, pituitary, or optic chiasm

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Angiofibroma Staging (Radkowski)

Radkowski Staging – 1996

- 1a – limited to the nose and nasopharyngeal area
- 1b – Extension into one or more sinuses
- 2a – Minimal extension into pterygopalatine fossa
- 2b – Occupation of the pterygopalatine fossa without orbital erosion
- 2c – Infratemporal fossa extension without cheek or pterygoid plate involvement
- 3a – Erosion of the skull base (middle cranial fossa or pterygoids)
- 3b – Erosion of the skull base with intracranial extension with or without cavernous sinus involvement

Treatment

Treatment of choice is surgery.

a. For tumor limited to nasopharynx and nose.
   1. THE ENDOSCOPIC APPROACH IS THE BEST APPROACH.
   2. WILSON'S TRANSPALATINE APPROACH.

b. for tumor extending to the cheek.
   1. Lateral rhinotomy with medial maxillectomy approach.
   2. Trans maxillary Le Fort I approach.
   3. Midfacial degloving approach

NASOPHARYNGEAL CARCINOMA

Nasopharyngeal Carcinoma 00:01:00

- Nasopharyngeal carcinoma is more common in CHINA.
- Etiology of NPC

  1.Epstein Barr virus.

  2.Genetics (HLA A2, A8, B46)
- Markers for screening-

  1.IgA antibodies to viral early antigen (EA)

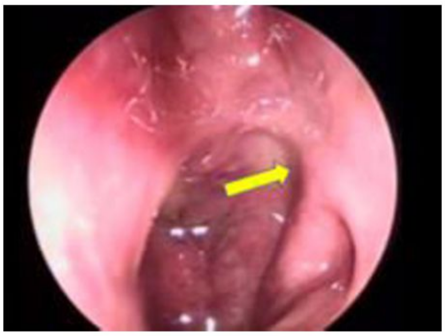
  2.IgA antibodies to viral capsid antigen (VCA)
- Age distribution-Bimodal distribution

  - Mostly in the 5th - 7th decade.
  - It can also be seen in younger population

Histopathology types-

Type 1	keratinising Carcinoma	(25%)
Type 2	Non keratinizing differentiated carcinoma	(12%)
Type 3	non keratinising undifferentiated carcinoma	(63%)

- Site of origin- it is a fossa of Rosenmuller, it lies just above the eustachian tube opening.



Fossa Rossenmuller Fig: 1

Mechanism of Unilateral conductive hearing loss in NPC

NPC
↓
Unilateral ET Blockage
↓
Unilateral Glue Ear
↓
Unilateral Conductive Hearing Loss

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- Nasopharyngeal carcinoma is hidden cancer (occult primary). Therefore, the most common presentation is secondary neck nodes (=metastatic cervical lymphadenopathy).

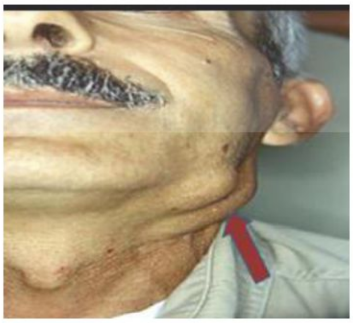


Fig: 2

- First lymph node to be involved- retropharyngeal lymph nodes, and then it reaches cervical lymph nodes.

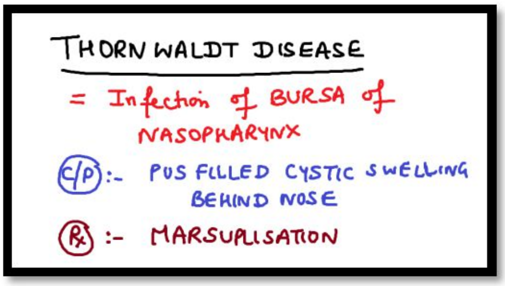
- Nasopharyngeal carcinoma is a skull base cancer, it enters the cranial cavity through foramen lacerum. Therefore, cranial nerve palsy is the very common clinical feature of this tumor. Most common nerve to be involved is the 6th cranial nerve.
- It can also involve jugular foramen, hypoglossal canal, hence causing 9th 10th, 11th, 12th cranial nerve paralysis.
- All cranial nerves can be involved except 7th and 8th nerves.

Trotters Triad of NPC

- N- Neuralgia in temporo-parietal area due to 5th nerve involvement.
- P- Palatal palsy due to 10th nerve involvement.
- C- Conductive hearing loss which is unilateral.
  (All are ipsilateral)
- Diagnosis- nasopharyngoscopy + biopsy.
- Treatment- CHEMORADIATION (Cisplatin/5- FU + radiotherapy)

One more extra point about Nasopharynx to remember

What is Thornwaldt disease of nasopharynx?



THORNWALDT DISEASE

= Infection of BURSA of NASOPHARYNX

C/P :- PUS FILLED CYSTIC SWELLING BEHIND NOSE

Rx :- MARSUPLISATION

Fig: 3

OROPHARYNX

Oropharynx 00:01:00

- Imagine two lines.
  - One at the junction of anterior 2/3rd and posterior 1/3rd of tongue below and second at the junction of soft palate and hard palate above.
- Anterior to these two imaginary lines is oral cavity.
- Posterior to these two imaginary lines is Oropharynx

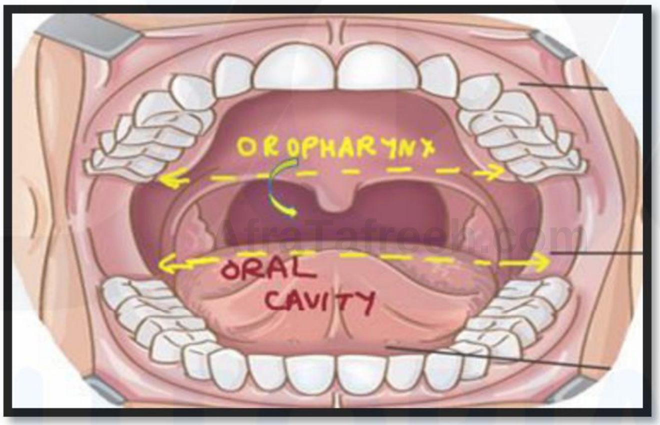

OROPHARYNX
ORAL
CAVITY

Fig: 1

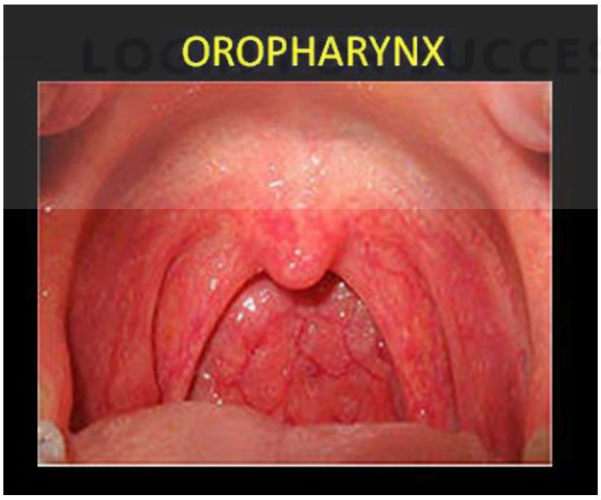

OROPHARYNX

Fig: 2

9 Parts of Oropharynx-

1. Soft palate.
2. Uvula.
3. Base of tongue (=posterior 1/3rd of tongue).
4. Lingual tonsil (These are lymphoid follicles on base of tongue).
5. Vallecula- is the space between the base of tongue and epiglottis
6. Anterior tonsillar pillar (is made by palatoglossus muscle).
7. Posterior tonsillar pillar (is made up of palatopharyngeus muscle).
8. Tonsil =palatine tonsil is lying between anterior pillar and posterior pillar.
9. Posterior pharyngeal wall.

Tonsil/ Palatine Tonsil

- The bed of tonsil is made by superior constrictor muscle.
- 2 structures lie in bed of tonsil

  1.Styloid process.

  2.Glossopharyngeal nerve.

STYALGIA (= EAGLE SYNDROME)

- In styalgia, the Long styloid process touches the 9th nerve, it leads to throat pain referred to ear.

- Treatment- Styloidectomy (it is done after doing tonsillectomy)

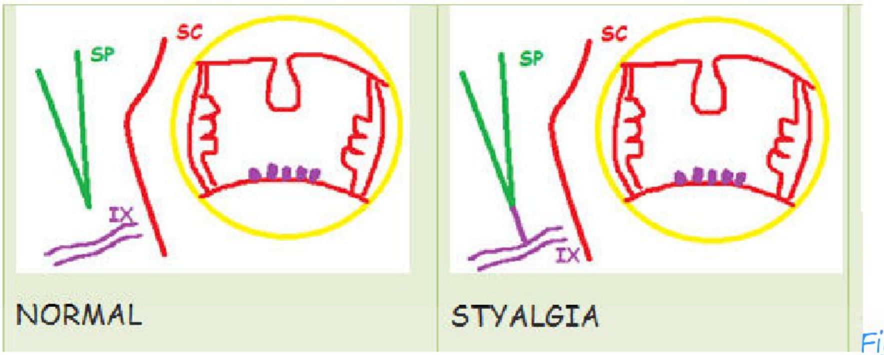

SP
SC
IX
NORMAL
SP
SC
IX
STYALGIA

Fig: 3

Clinical Anatomy

- Internal carotid artery (ICA) lies one inch deep to TONSIL. Therefore, ICA aneurysm may present as pulsating tonsil

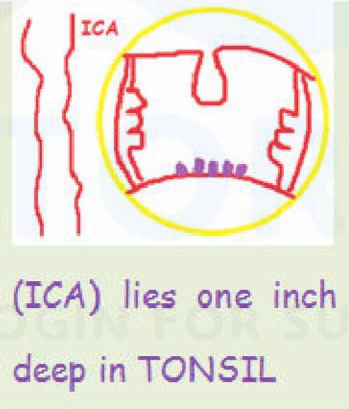

ICA
(ICA) lies one inch
deep in TONSIL

Fig: 4

Special Surgeries of Oropharynx

1. LASER PALATOPLASTY – Done for the management of snoring.
2. UVULOPALATOPHARYNGOPLASTY – done for the management of obstructive sleep apnea.

TONSIL

- Tonsil is a lymphoid tissue.
- Tonsil is lined by non-keratinizing stratified squamous epithelium.
- It has a capsule.
- It has crypts. The largest or deepest crypt is called Crypta Magna.

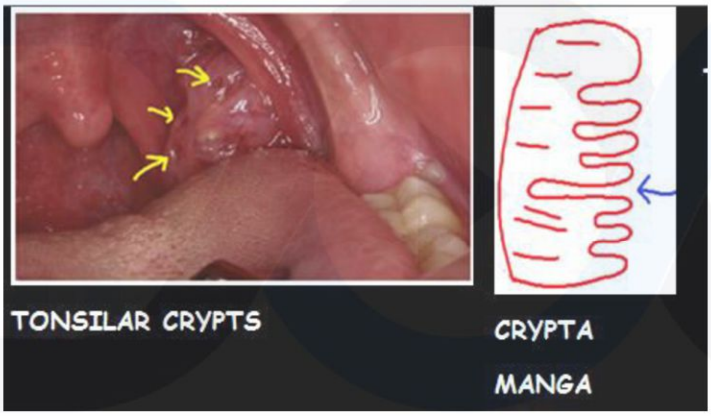
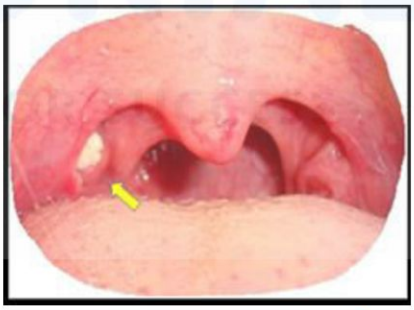


Fig: 1

Tonsillitis The collection of keratin debris in tonsillar crypt which present as whitish hard mass is called tonsillitis.	 Fig: 2

Blood supply of tonsil

- Tonsil has a definite blood supply. The main blood supply is the tonsillar branch of the facial artery.
- Other arteries-

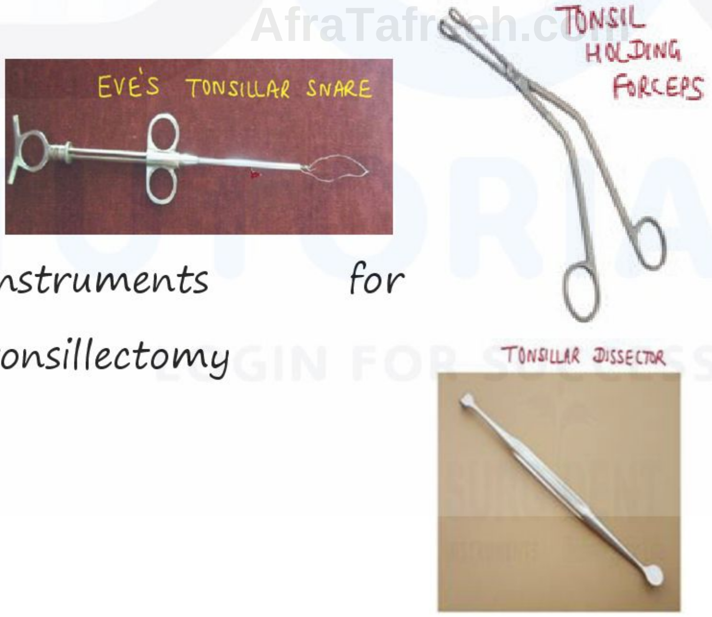
- Ascending pharyngeal artery.
- Ascending palatine artery.
- Descending palatine artery.
- Branches of lingual artery.

- Venous drainage of tonsil - Paratonsillar vein.

It is the main source of bleeding during tonsillectomy.

Tonsillectomy by dissection & snare method

- Most common and conventional method of tonsillectomy is dissection and snare method. The instruments used in this technique are shown in picture


EVE'S TONSILLAR SNARE
TONSIL HOLDING FORCEPS
TONSILLAR DISSECTOR

Instruments for tonsillectomy

Fig: 3

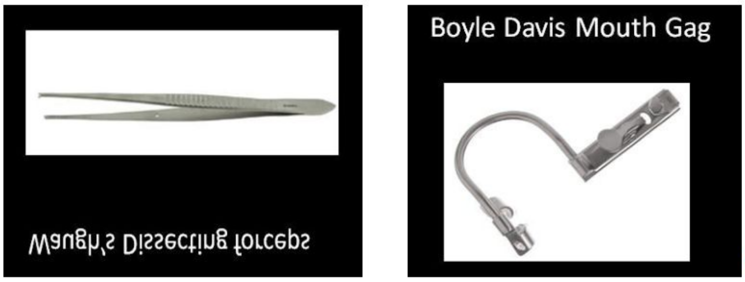

Waugh's Dissecting forceps
Boyle Davis Mouth Gag

Fig: 4

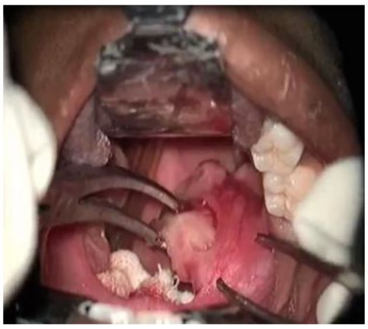
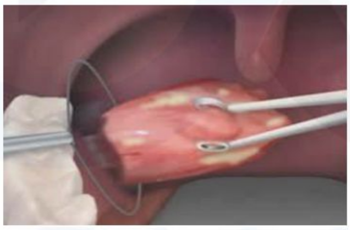


Fig: 5

- See the operative image-- Tonsil is held with tonsil holding forceps and incision is given on anterior tonsillar pillar at upper pole with help of Waugh's Dissecting forceps. Later, the tonsil is dissected off the fossa using tonsillar dissector and pillar retractor

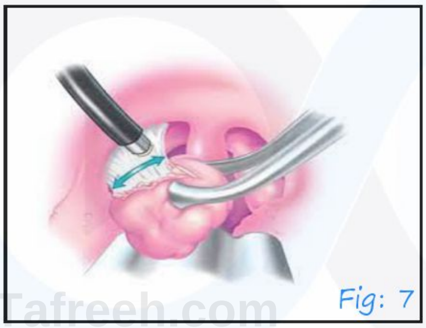
After dissecting the tonsil from its fossa, EVE'S TONSILLAR SNARE is used to crush and cut the lower pole of pedunculated tonsil.	 Fig: 6

Haemorrhage in tonsillectomy

- 3 types
  - Primary haemorrhage- during surgery.
  - Reactionary haemorrhage within 24hrs of surgery, cause is slippage of ligature. It is an emergency. Treatment is immediate Re-exploration in operation theatre under general anaesthesia.

- Secondary haemorrhage post operative bleed after 24 hrs. It is mostly after 5th day of surgery. It is due to infection of tonsillar fossa. It is a mild bleeding only. Dirty greyish slough is seen in tonsillar fossa (normal slough is whitish). VIVA
- Treatment- Intravenous antibiotics.

New methods of tonsillectomy

1. Bipolar diathermy. 2. Coblation. 3. Microdebrider 4. Radiofrequency. 5. Harmonic scalpel. 6. Laser. 7. Cryosurgery.	 Fig: 7 Coblation Tonsillectomy

- The main advantage of these methods is less blood loss.

Fig: 8

Techniques of tonsillectomy

Cold methods	Hot methods
Dissection and snare	Electrocautery
Intracapsular with debrider	Laser tonsillectomy
Harmonic scalpel	Coblation
Cryosurgical technique	Radiofrequency

Whitish membrane over tonsil

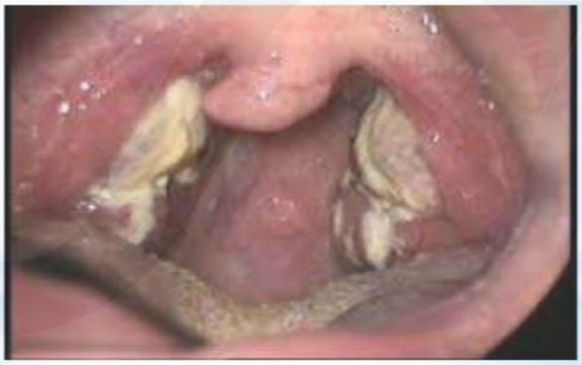


Fig: 9

Causes

- Acute membranous tonsillitis caused by streptococcus pyogenes.
- Infectious mononucleosis caused by Ebstien barr virus.
- Diphtheria. - diphtheria membrane extends beyond tonsil to palate. MCQ
- Candidiasis.
- Vincent angina. (Borrelia Vincente & Fusiform bacillus)
- Malignancy of tonsil (will be unilateral)
- Leukaemia and agranulocytosis.

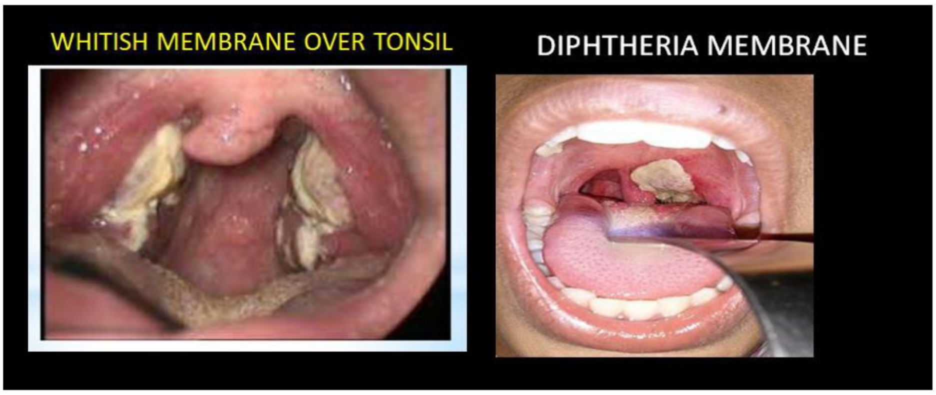

WHITISH MEMBRANE OVER TONSIL
DIPHTHERIA MEMBRANE

Fig: 10

Waldeyer ring

- It is a ring of lymphoid tissue in pharynx. it has 6 parts-
  - Adenoid.
  - Tubal tonsil around the Eustachian tube.
  - Palatine tonsil.
  - Lingual tonsil on the base of tongue.
  - Lateral pharyngeal bands.
  - Lymphoid follicle on posterior pharyngeal wall.

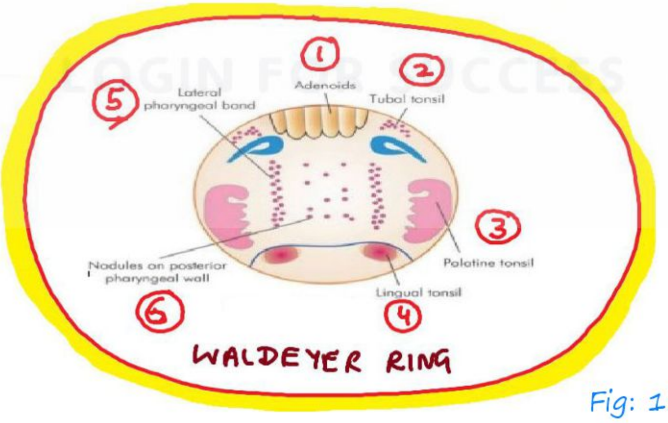

①
Adenoids
②
Tubal tonsil
⑤
Lateral pharyngeal band
③
Palatine tonsil
Nodules on posterior pharyngeal wall
Lingual tonsil
⑥
④
WALDEYER RING

Fig: 11

Clinical Anatomy

- Lymphoid follicles on posterior pharyngeal wall can show hypertrophy; this is called cobblestone appearance of the mucosa. (See the image)

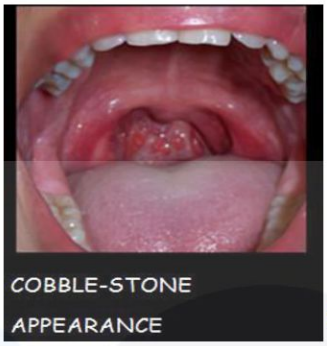

COBBLE-STONE
APPEARANCE

Fig: 12

ABSCESSES OF PHARYNX

Quinsy= peritonsillar abscess

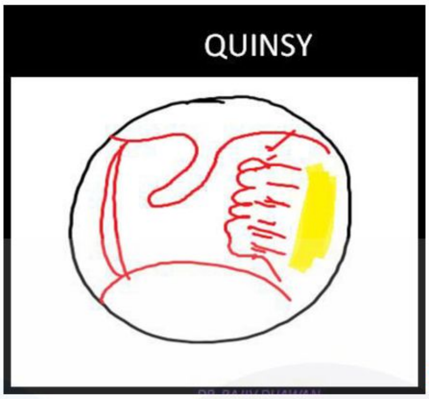


Fig: 1

- It is a collection of pus between tonsil and its bed (superior constrictor muscle).
- Quinsy is more common in adults, but can also be seen in children.
- It is mostly unilateral.
- It mostly follows an episode of acute tonsillitis

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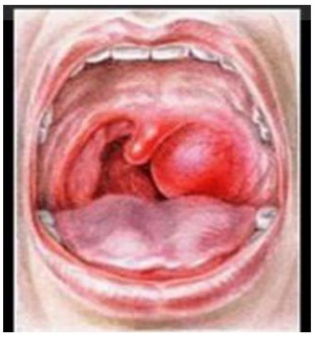
Examination findings- A. Tonsil is pushed medially. B. Uvula pushed to other side. (Uvula is angulated) There is no outer neck swelling	 Fig: 2 **Quinsy**

Chief Complaints-	
1. Throat pain. 2. Dysphagia. 3. Hot potato= plummy voice. 4. Trismus- it is difficult to open mouth. It is due to spasm of medial pterygoid muscle.	

- Treatment- incision and drainage (I&D) followed by tonsillectomy after 6 weeks. This is called interval tonsillectomy. Some surgeons remove tonsil at the time of abscess drainage. This is called abscess tonsillectomy.
- Site of I & D is at the point of maximum fluctuant swelling or where lines along the base of uvula and anterior pillar intersect.

DOC TUTORIALS LOGIN FOR SUCCESS

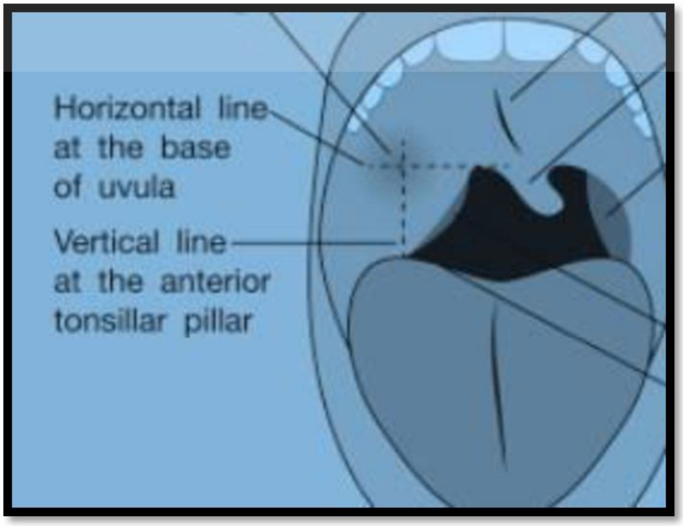

Horizontal line at the base of uvula
Vertical line at the anterior tonsillar pillar

Fig: 3

- I & D_is done using quinsy forceps or a 15 number surgical blade with tape applied to it to prevent the overpenetration (see image).

Quinsy forceps – its tip ends open when prongs are closes

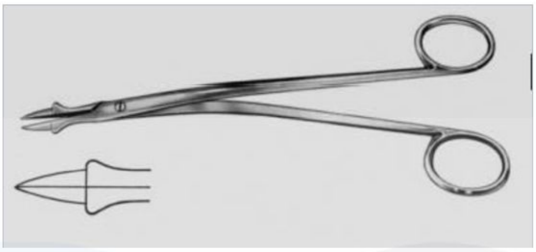


Fig: 4

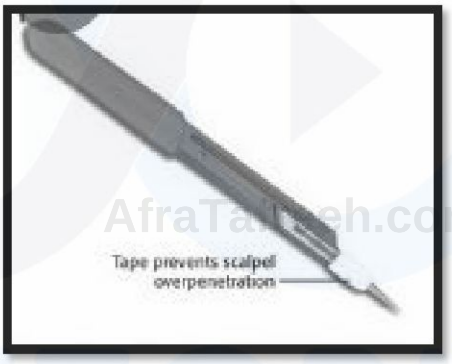


Fig: 5

Parapharyngeal abscess (differential diagnosis of Quinsy)

- Q. If same history and examination finding as of quinsy are given in the question and along with that there is neck swelling close to angle of mandible or sternocleidomastoid muscle
- Answer is- parapharyngeal abscess. (In Quinsy, there is no external neck swelling

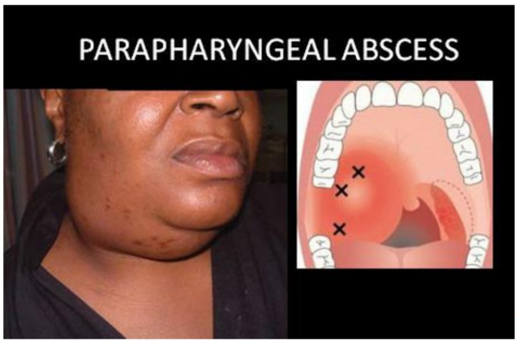

PARAPHARYNGEAL ABSCESS

Fig: 6

Causes of parapharyngeal abscess

- Tonsillitis.
- Dental infection.
- Penetrating neck injuries.
- Symptoms: Neck swelling, Trismus, Plummy voice, dysphagia
- Treatment - external I & D

Quincke's disease-

- it is angioneurotic edema of uvula. (Do not confuse with the word Quinsy)

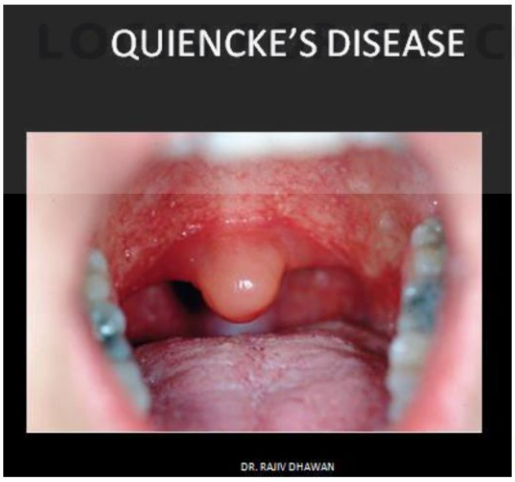

QUIENCKE'S DISEASE
DR. RAJIV DHAWAN

Fig: 7

Petropharyndeal space (RPS)& prevertebral space (PVS)

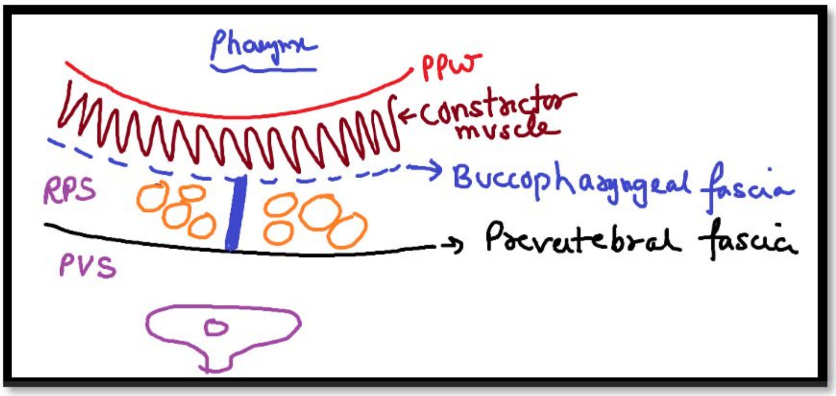

Pharynx
PPW
constrictor muscle
Buccopharyngeal fascia
RPS
Prevertebral fascia
PVS

Fig: 8

- Retropharyngeal space is divided into two halves by a midline band, these 2 spaces are called spaces of GILLETTE. These spaces have retropharyngeal lymph nodes also called lymph nodes of ROUVEIRE.

Acute retropharyngeal abscess

- Infection of retropharyngeal lymph nodes will lead to acute retropharyngeal abscess.
- Acute retropharyngeal abscess is more common in children. It is a paediatric airway emergency.

DOC TUTORIALS

Clinical Picture

A very sick baby, mostly around 2 years of age with

- With respiratory difficulty.
- Inspiratory stridor.
- hot potato voice. (Plummy voice)

Examination shows unilateral bulge on posterior pharyngeal wall

- Differential diagnosis- acute epiglottitis.
- X ray soft tissue of neck lateral view shows widening of prevertebral shadow with normal cervical spine.
- In acute epiglottitis X ray shows thumb sign.

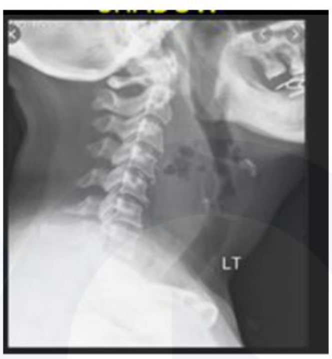


Fig: 9

Treatment-

- Airway management
- Per oral incision and drainage.

Prevertebral abscess

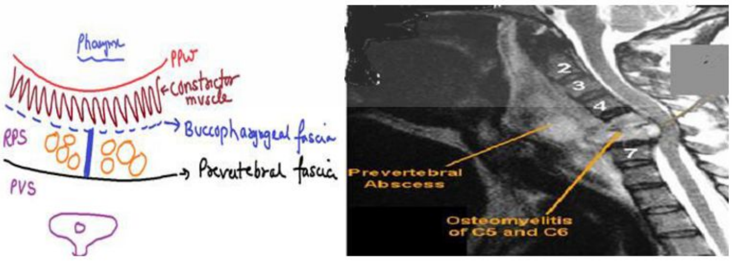

Pharynx
PPW
constrictor muscle
Buccopharyngeal fascia
RPS
Prevertebral fascia
PVS
2
3
4
7
Prevertebral Abscess
Osteomyelitis of C5 and C6

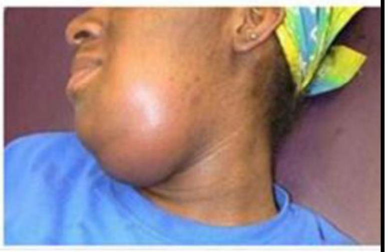
Fig: 10

- This is due to TB of cervical spine. It is a chronic abscess.
- Examination- shows midline diffuse bulge on posterior pharyngeal wall

- Clinical picture- adult patient with long standing symptoms of
  - Neck pain.
  - Dysphagia.
  - Hot potato or plummy voice
- X ray neck findings
- Widening of prevertebral shadow.
- Erosion of vertebral bodies (Pott spine features).
- Treatment- needle aspiration of abscess from non-dependent part(anti-gravity) + ATT.

Ludwig's Angina

- It is an infection of the floor of the mouth (floor of mouth is also called submandibular space). Floor of the mouth is made up of mylohyoid muscle.
- Sub mandibular space = sublingual space + submaxillary space.
- Source of infection is dental caries.

C/C- • Chin Swelling. • Trismus. • +/- respiratory distress • Bacteriology: mixed, streptococci and anaerobes. • Treatment- external I&D, antibiotics, +/- tracheostomy.	 Fig: 11 **Ludwig angina**

Causes of Hot potato Voice (Viva question)

- Quinsy
- Acute Retropharyngeal abscess
- Prevertebral abscess
- Supraglottic cancer
- Base Tongue Cancer

EXTERNAL NOSE

- The External nose is made up of 4 paired structures-
  - Nasal bones
  - Upper lateral cartilages
  - Lower lateral cartilage/ Alar cartilage. These are U shapes cartilages. They form external nasal opening.
  - Lesser Alar or Sesamoid cartilage. These are the small cartilages lying between upper lateral and lower lateral cartilages.

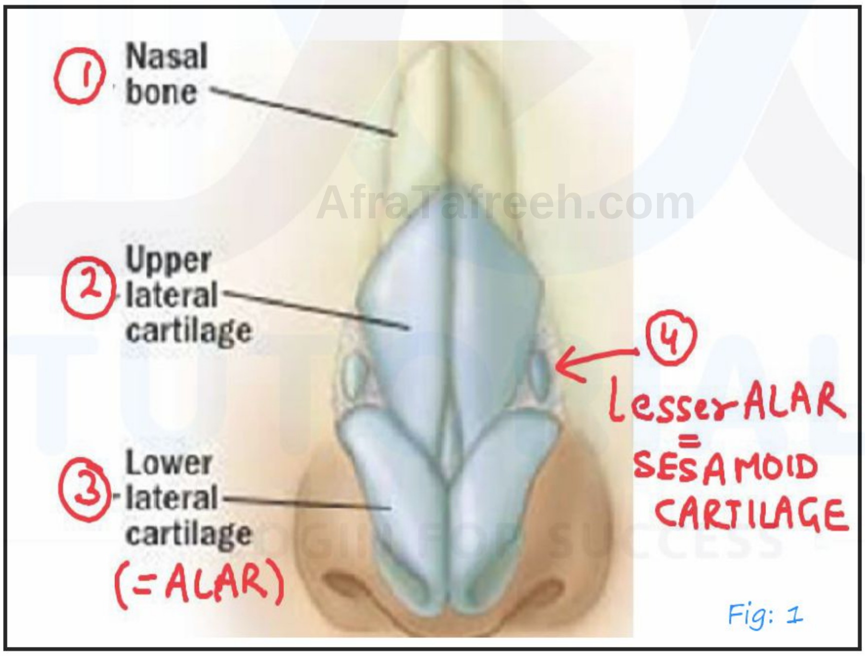

① Nasal bone
② Upper lateral cartilage
③ Lower lateral cartilage
(=ALAR)
④ Lesser ALAR = SESAMOID CARTILAGE
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Fig: 1

Limen nasi

- It is a junction of upper lateral cartilage and lower lateral cartilages.
- This forms the outer boundary of the nasal valve.
- The Inner boundary of the nasal valve is formed by the nasal septum

Nasal valve collapse 00:06:30

- Cottles test- it is done to check the blockage of the nasal valve. Put two fingers on the cheek and lift the cheek upwards, if it makes breathing better than it is nasal valve collapse.

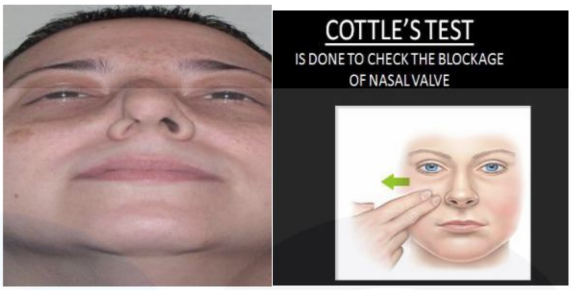

COTTLE'S TEST
IS DONE TO CHECK THE BLOCKAGE OF NASAL VALVE

Fig: 2

Defects in the shape of external nose 00:07:35

Fig: 3

Saddle nose 00:07:35

- Means depression in the dorsum of nose which is just like a Concavity.

Causes

- Septal surgery
- Trauma
- Leprosy
- Syphilis
- Tuberculosis

Treatment

- Surgery called AUGMENTATION RHINOPLASTY by using iliac crest graft.

Hump nose 00:09:43

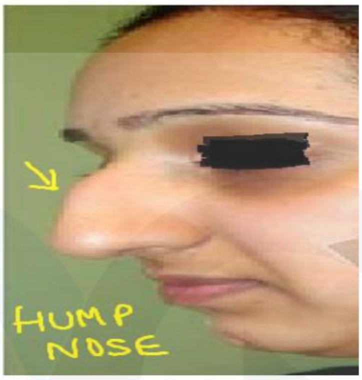


Fig: 4

- Convexity on the dorsum of nose
- Cause – Trauma due to birth
- Opposite to saddle nose
- Treatment- surgery called reduction rhinoplasty.

3. If midline gets deformed, there can be two types of deformities:

   - Crooked Nose
   - Deviated Nose

Crooked nose	Deviated nose
• Dorsum is deviated but tip is in midline. • Nose is C shaped.	• Dorsum and tip are straight but both deviated to one side.

TUTORIALS LOGIN FOR SUCCESS

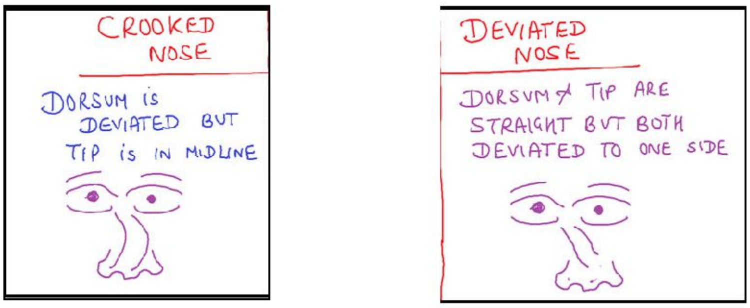

CROOKED NOSE
DORSUM is DEVIATED BUT TIP is IN MIDLINE
DEVIATED NOSE
DORSUM & TIP ARE STRAIGHT BUT BOTH DEVIATED TO ONE SIDE

Fig: 5

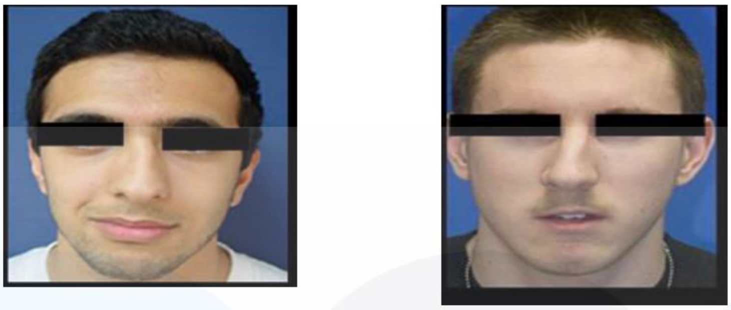


Fig: 6

Basal cell carcinoma

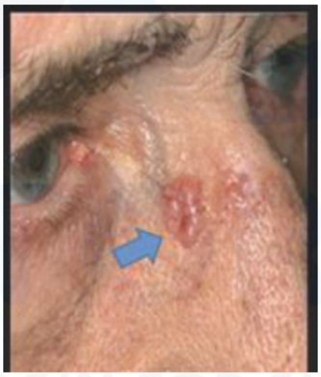


Fig: 7

- It is also called as rodent ulcer.
- It is the most common malignancy of the skin of the external nose,
- Presents as ulcerative, telangiectatic lesion with rolled out edges
- It's a slow growing cancer. Lymph Node metastasis is rare in basal cell carcinoma.
- Treatment - wide surgical excretion.

Rhinophyma 00:14:53

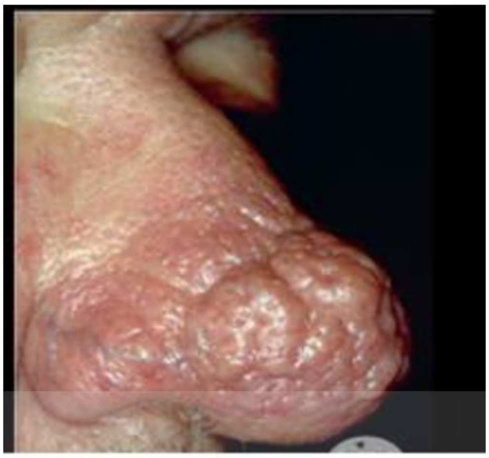


Fig: 8

- It is also called potato nose.
- It is hypertrophy of sebaceous glands of the skin of external nose.
- It is more commonly seen in males.
- It is a type of acne rosacea.
- It is not related to alcohol consumption.
- Treatment- LASER EXCISION + skin grafting.

Clinical Scenario based Question 00:16:42

- Q. A young child with cystic swelling in or around the nose.
  - What is the investigation of choice and why?
  - Answer: CT SCAN.
  - There can be three possibilities:

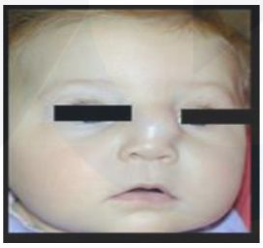
    a) Nasal dermoid.

    b) Nasal encephalocele.

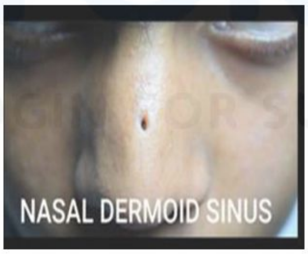
    c) Nasal glioma.

Nasal dermoid 00:18:08

- A simple nasal dermoid is cystic swelling in midline over the dorsum of nose.
- There can be Nasal dermoid with sinus opening in the dorsum of nose
- This sinus can have intracranial communication, that's why we do CT scan to see communications before excision
- Treatment – surgical excision of dermoid with sinus tract



Simple nasal dermoid



Nasal dermoid sinus Fig: 9

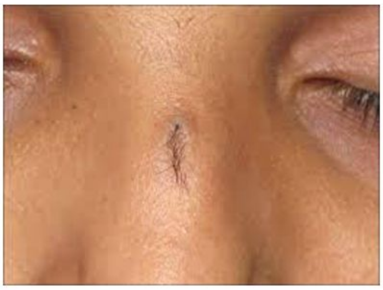


Fig: 10

Nasal dermoid with hair present at sinus opening site

Nasal encephalocele 00:18:23

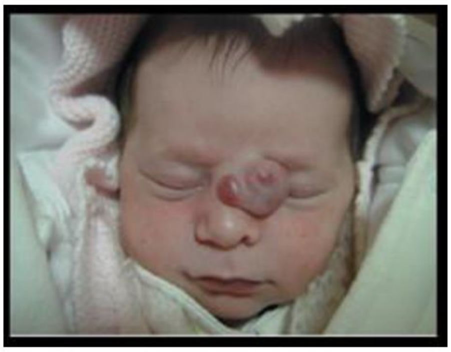


Fig: 11

- Most serious
- It is herniation of the brain/meninges into the roof of the nose.
- This swelling can be pulsatile, reducible and increases in size on coughing or crying. This is called FURSTENBERG TEST POSITIVE.

Nasal glioma 00:20:23

- It is an encephalocele only whose connection with the brain has disappeared on CT scan.
- In nasal glioma, FURSTENBERG TEST IS NEGATIVE.

LATERAL WALL OF NOSE/ NASAL CAVITY

Turbinate's

- These are projections on the lateral wall of nose. There are three turbinates':

  a) Inferior turbinate (IT) – longest turbinate.

  b) Middle turbinate (MT)

  c) Superior turbinate (ST)

- What is supreme turbinate?
  - It is an anatomical variation
  - It is an extra turbinate above ST

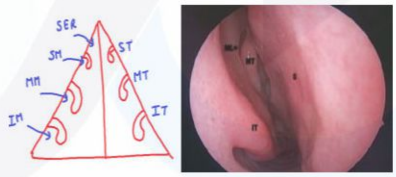


Fig: 1

Meatus

- It is a space below the turbinate. There are 3 meatus.

  a) Inferior meatus (IM)

  b) Middle meatus (MM)

  c) Superior meatus (SM)

Sphenoethmoidal recess-

- This is the area above the superior turbinate. (SER)

Anatomical variation

- Some people have extra turbinate above superior turbinate it is called supreme turbinate.

Concha

- Concha is the bony part of turbinate.
- There are 3 conchae.

  a)Inferior concha - it is an independent bone (MCQ)

  b)Middle concha

  c)Superior concha
- Superior and middle concha are part of the ethmoid bone.

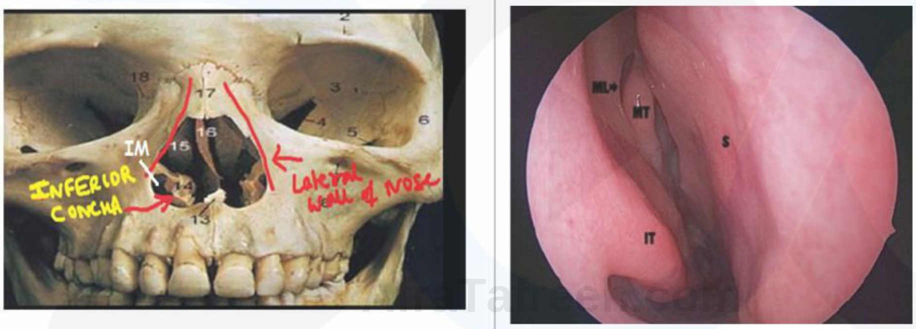

2
18
17
3
4
5
6
16
IM
15
13
INFERIOR CONCHA
Lateral wall of nose
ML
MT
S
IT

Fig: 2

Choana

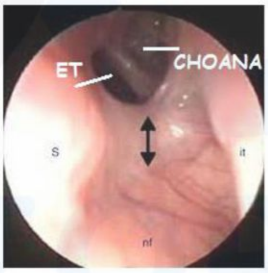
- Choana is the posterior opening of the nasal cavity.
- Behind the choana lies the nasopharynx.

Choanal atresia

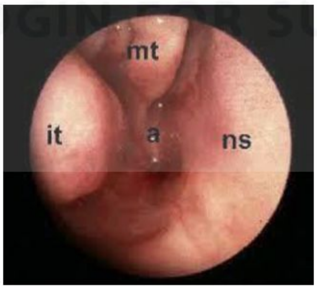
- It is a congenital disorder.
- Chona is not patient
- It is due to persistence of the bucconasal membrane after birth. It can be unilateral or bilateral.
- It can be bony or membranous.
- It can be complete or incomplete.

Bilateral complete choanal atresia

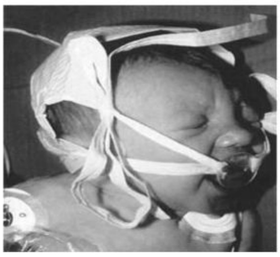
- It is a neonatal airway emergency, because neonates are obligatory nasal breathers. (Mouth breathing is an acquired reflex)
- Baby is cyanosed immediately after birth but turns pink on crying (blue baby turns pink on crying).
- Immediate management is putting wide bore nipple in baby's mouth to keep it open
- It is called McGovern's Technique.
- Then do tracheostomy.
- At one year of age, plan to do recanalization surgery.



Normal choana



Chonal atresia



McGovern's TECHNIQUE Fig: 3

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PARANASAL SINUSES

Introduction:

- Sinuses are hollow cavities in skull bones
- These are mucosa lined air-filled hollow cavities in skull bones.
- They are ventilated during EXPIRATION.
- The nose and paranasal sinuses are lined with respiratory mucosa composed of pseudo stratified ciliated columnar epithelium.
- Mucosa of Paranasal sinus secretes mucus.
- Due to ciliary motility, the mucus is drained into the nose through the opening of sinus called ostium.

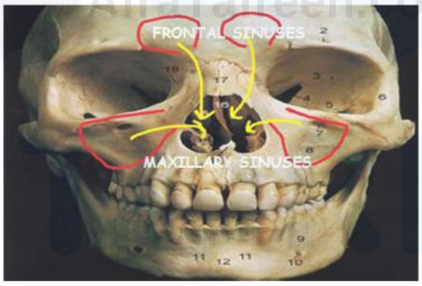


Fig: 1

- Nasal cilia move backwards at the speed of 10- 20 beats/sec to push mucus towards choana to nasopharynx
- Nasal mucociliary clearance time (time taken for mucus to reach from anterior end of the nose to the posterior end of choana) is 10-20 minutes.
- Ciliary defect can lead to sinusitis
- There are 4 pairs of sinuses:

Maxillary sinus 00:06:45

Fig: 2

- This is also called antrum (maxillary sinus) OF HIGHMORE.
- This is the largest sinus.
- Volume is 15ml.
- It is pyramidal in shape.

Boundaries:

- Base of maxillary sinus is towards the lateral wall of the nose.
- Apex of maxillary sinus is towards zygomatic area.
- Floor of maxillary sinus is related to 2nd premolar and first molar
- Maxillary sinus drains into the middle meatus.
- There is accessory ostium seen in 30% cases.

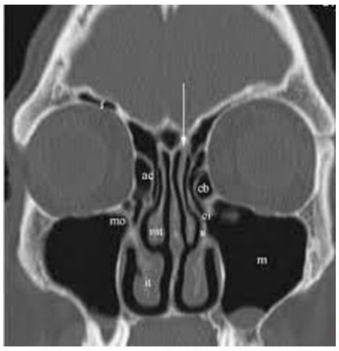


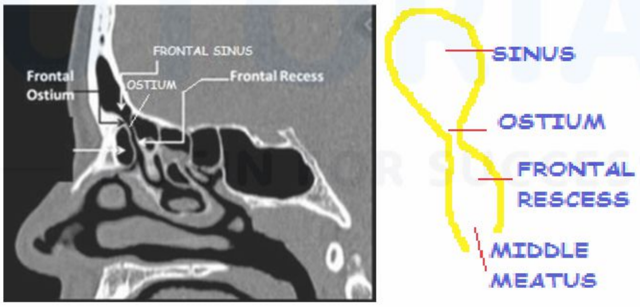
Fig: 3

Oroantral fistula

- (ORO = mouth, ANTRUM = maxillary sinus).
- There is possibility of oroantral fistula as a complication of dental extraction as floor is related to second premolar and first molar.

Frontal sinus 00:11:42

- Above the orbit is frontal sinus; below the orbit is maxillary sinus.
- Frontal sinus is the most asymmetric pair of sinuses. (Anatomy Q) (right and left can vary a lot in size)
- Frontal sinus ostium opens into frontal recess which drains into middle meatus
- Frontal sinus→ Ostium→ Frontal Recess → Middle meatus

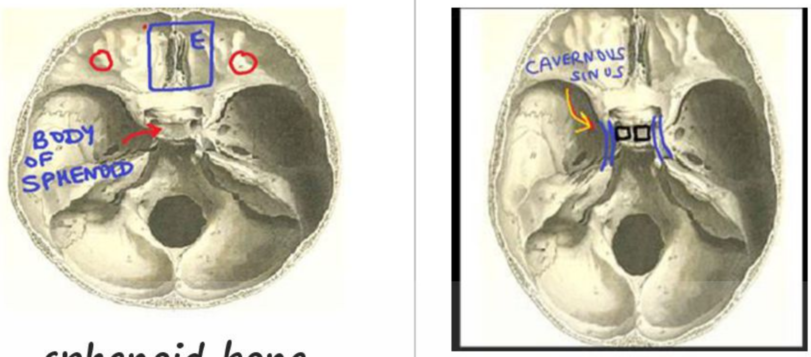

FRONTAL SINUS
Frontal Ostium
OSTIUM
Frontal Recess
SINUS
OSTIUM
FRONTAL RESCESS
MIDDLE MEATUS

sagittal section CT scan Fig: 4

Sphenoid sinus 00:14:20

- Sphenoid sinus lies in the body of a sphenoid bone which lies behind the orbit. (See the first image below)
- Sphenoid bone is pneumatic bone with a pair of sphenoid sinuses

- It is also an asymmetric pair of sinuses. (After frontal sinus.)



sphenoid bone

cavernous sinus

Fig: 5

Relations of sphenoid sinus:

- Sphenoid sinus closely related to cavernous sinus; therefore, sphenoid sinusitis can lead to CAVERNOUS SINUS THROMBOSIS (intracranial complication). (CLINICAL MCQ)
- Lateral wall of sphenoid sinus is related to optic nerve and internal carotid artery.
- Therefore, optic nerve injury and ICA injury can be seen as a complication of sphenoid sinus surgery. (CLINICAL MCQ)
- Roof of the sphenoid sinus is related to pituitary gland in Sella turcica. (Sella turcica is a depression in the sphenoid bone, containing the pituitary gland.).
- Therefore, best surgical approach for pituitary adenoma removal is Endoscopic transnasal transsphenoidal approach.

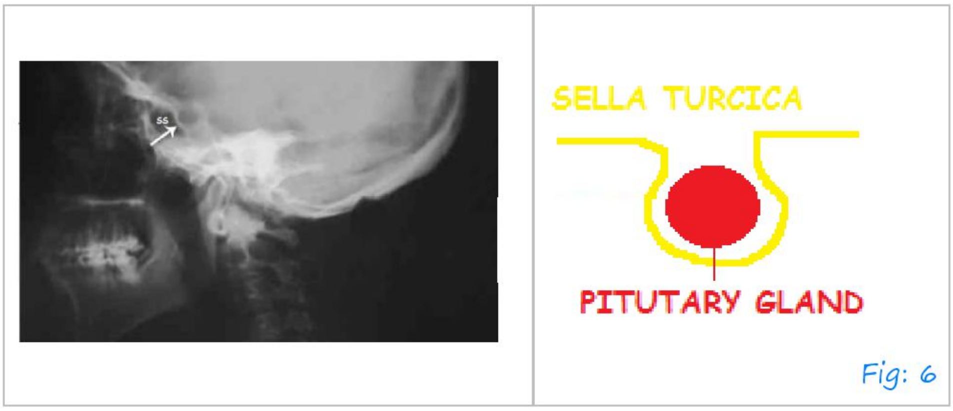

SS
SELLA TURCICA
PITUTARY GLAND

Fig: 6

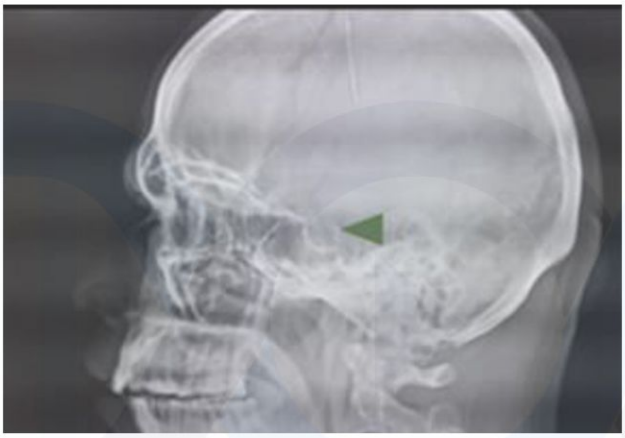


Fig: 7

TUTORIALS
LOGIN FOR

Pneumatization of sphenoid sinus. 00:22:17

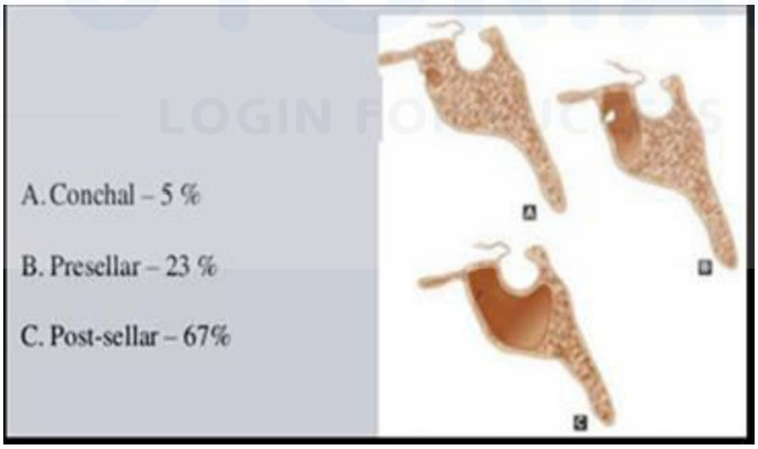

A. Conchal – 5 %
B. Presellar – 23 %
C. Post-sellar – 67%
A
B
C

Fig: 8

- Extent of pneumatisation of sphenoid sinus is of three types
  - Conchal – 5%
  - Pre-seller – 23%

- Sellar or post seller – 67% – (Q). This is the commonest pneumatisation pattern.

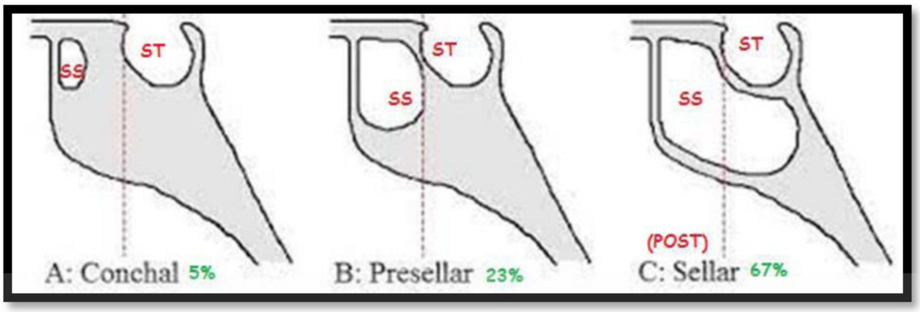

ST
SS
A: Conchal 5%
ST
SS
B: Presellar 23%
ST
SS
(POST)
C: Sellar 67%

Fig: 9

ETHMOID AIR CELLS (ETHMOID SINUS)

4. Ethmoid sinus/ ethmoid air cells

- Ethmoid sinus is not a single cavity; it is a collection of multiple air cells
- Ethmoid air cells – they are divided into 2 groups by a bony plate called ground lamella or basal lamella.

General concept

- Big hollow cavity in skull-sinus
- Small hollow cavities-air cells

Ethmoid bone (see image)

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- Ethmoid bone is the single bone between 2 orbits which contains ethmoid air cells.

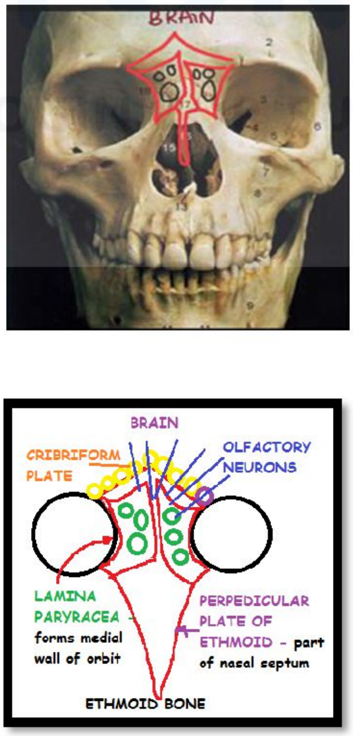
BRAIN
BRAIN
CRIBRIFORM PLATE
OLFACTORY NEURONS
LAMINA PARYRACEA - forms medial wall of orbit
PERPEDICULAR PLATE OF ETHMOID - part of nasal septum
ETHMOID BONE

Fig: 1

Ethmoid bone Parts

- Cribriform plate is part of ethmoid bone. Olfactory neurons pass through cribriform plate
- Perpendicular plate of ethmoid – forms part of nasal septum. Septal cartilage joins with perpendicular plate of ethmoid to form nasal septum
- Lamina Papyracea forms part of medial wall of orbit
- Middle and superior concha are part of ethmoid bone

Ethmoid air cells

- Ethmoid air cells are divided into 2 groups by a bony plate called GROUND LAMELLA or BASAL LAMELLA. These groups are called anterior and posterior ethmoid air cells.

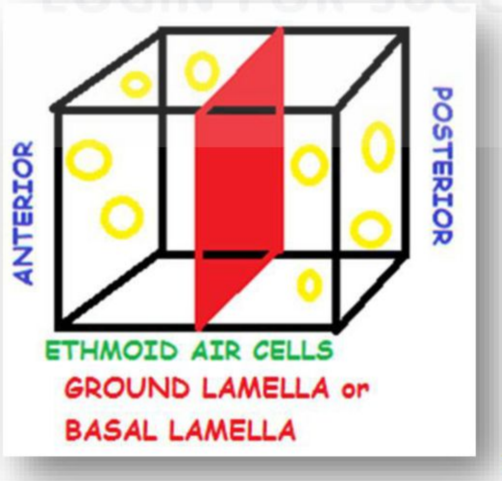
ANTERIOR
POSTERIOR
ETHMOID AIR CELLS
GROUND LAMELLA or
BASAL LAMELLA

Fig: 2

- Anterior ethmoid air cells
- Posterior ethmoid air cells.

ANTERIOR (number of cells)	POSTERIOR
2 –8	1 –8
2 anterior cells are constant	

Two constant Anterior ethmoid air cells

- 1st – bulla ethmoidal is, most constant and largest anterior ethmoid air cell
- 2nd – agger nasi – Anterior most anterior ethmoid air cell
- Radiological appearance of ethmoid air cells

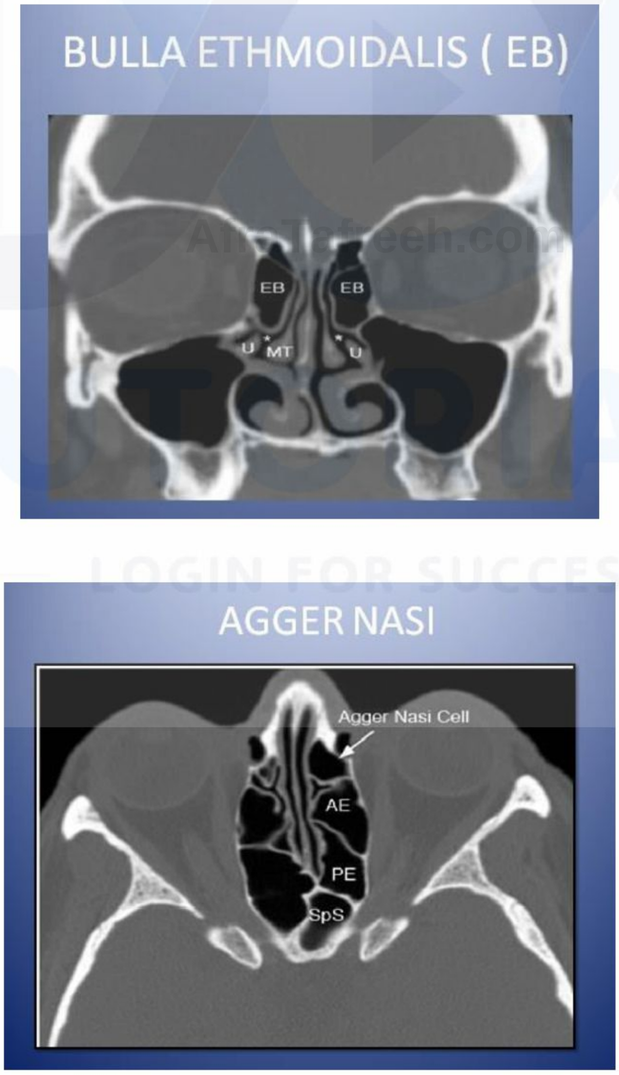
BULLA ETHMOIDALIS (EB)
EB
EB
U
MT
U
AGGER NASI
Agger Nasi Cell
AE
PE
SpS

Fig: 3

Anatomical variation 00:13:40

- In some people, ethmoid air cells can grow in 3 unusual locations. Depending upon these locations, these cells are given unique names which are as follows: 1. Concha bullosa. 2. Haller cell 3. Onodi cell. (See image). They can be seen on CT scan of sinuses.

Concha bullosa 00:15:40

- Anterior ethmoid air cell lying inside middle turbinate (pneumatisation of middle turbinate)

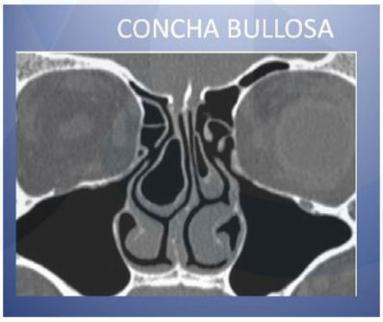

Fig: 4

- It is the most common variation and can lead to sinusitis.

Haller cell 00:19:30

- Anterior ethmoid air cell lying in orbital floor

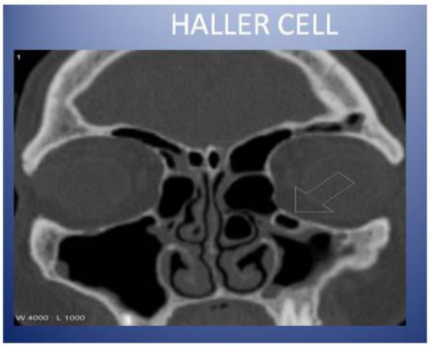

Fig: 5

Onodi cell 00:20:35

- Part of posterior ethmoid air cell lying close to optic nerve.

Unusual locations		
In orbital floor ↓	Close to optic nerve ↓	Inside middle turbinate ↓
Haller cells	Onodi cells	Concha Bullosa ↓
These cells can lead to complications during endoscopic sinus surgery		Most variation out of these ↓
		In can lead to sinusitis

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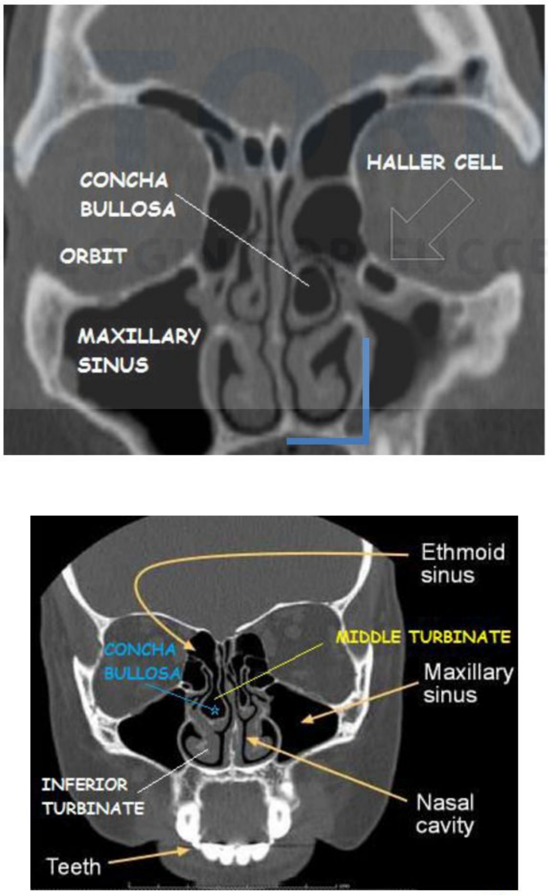
CONCHA BULLOSA
ORBIT
MAXILLARY SINUS
HALLER CELL
Ethmoid sinus
MIDDLE TURBINATE
CONCHA BULLOSA
Maxillary sinus
INFERIOR TURBINATE
Nasal cavity
Teeth

Fig: 6

SINUSES

Development of sinuses 00:00:33

- Radiological appearance of sinuses occurs is this order-
- M-E-S—F (MESF)

Sinus	Status at birth	Growth	First radiological evidence
Maxillary	Present at birth	Rapid growth from birth to 3 years. Adult size 15 years.	4-5 months after birth
Ethmoid	Present at birth	Reach adult size by 12 years.	1 year
Sphenoid	Not present	Reaches Sella turcica by the age of 7 years, dorsum sellae by late teen and basisphenoid by adult age. Adult size-	4 years

		15 years. It is the last sinus to complete its development (MCQ)	
Frontal	Not present	Invades frontal bone at the age of 4 years and size increases till teens.	6 years

---

Structures draining into nasal cavity (MCQ/VIVA)

00:05:25

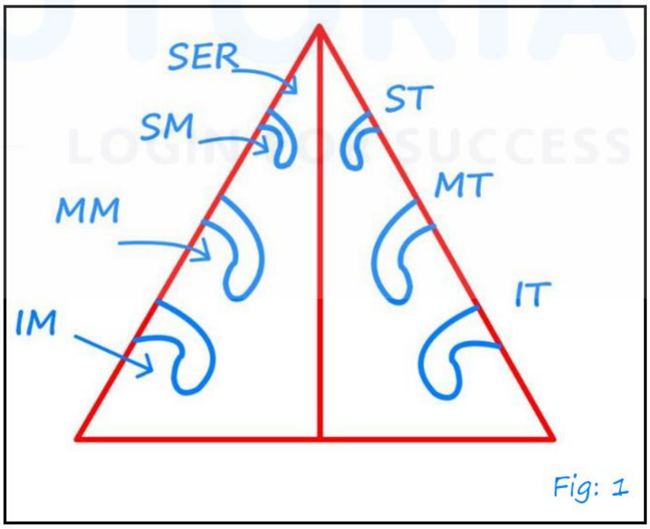

Fig: 1

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Structure	Drains into
Nasolacrimal duct	Inferior meatus.
Maxillary sinus	Middle meatus
Frontal sinus	Middle meatus
Anterior ethmoidal air cells	Middle meatus
Posterior ethmoidal air cells	Superior meatus.
Sphenoid sinus	SER (Spheno-Ethmoidal Recess)

- Please note that Most of the sinuses open into the middle meatus.

Lacrimal apparatus and chronic dacrocystitis

00:09:00

Q. Where is Surgical opening of DCR Made? Dacryocystorhinostomy (DCR) (making an opening of lacrimal sac in the nose) is made into middle meatus.

- It is a surgical procedure, which makes the opening of

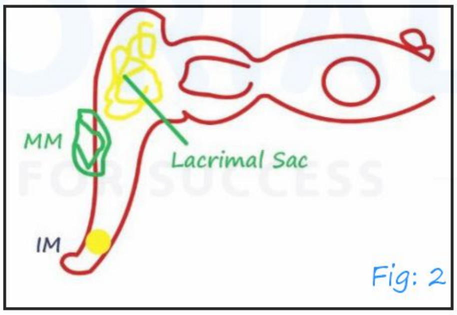

Fig: 2

It is a case of chronic Dacryocystitis due to Nasolacrimal duct blockage

lacrimal sac into middle meatus. - Natural opening of Nasolacrimal duct is in the Inferior meatus	

- Kerrison's endoscopic DCR punch

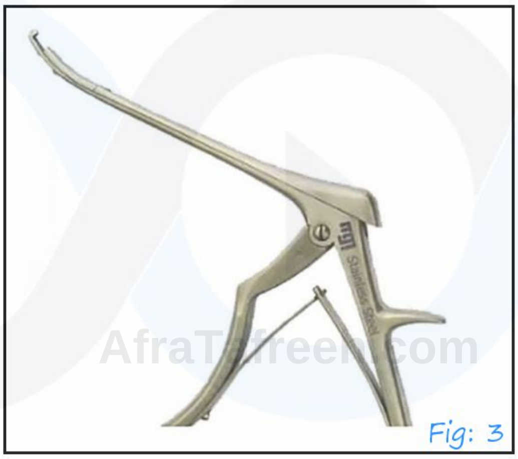

Fig: 3

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Middle meatus (MM) 00:14:55

- It is the most important area for sinus drainage. (Maxillary sinus, frontal sinus and anterior ethmoid air cells). It has 4 landmarks which are described below

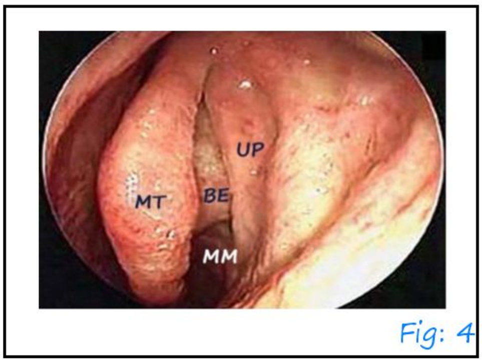

Fig: 4

Four Landmarks inside Middle meatus

Uncinate process (UP)	It is sickle shaped bone which covers bulla ethmoidalis. (Part of ethmoid bone only)
Bulla ethmoidalis (BE)	Most constant and largest ant. ethmoid air cell (part of ethmoid bone only)
Ethmoidal Infundibulum (EI)	It is the space between the uncinate process and bulla ethmoidalis.
Hiatus semilunaris	It is the imaginary two-dimensional entry door of ethmoidal infundibulum.

TUTORIALS LOGIN FOR SUCCESS

Osteomeatal complex (Piccadili's circle)

- Maxillary sinus, frontal sinus, anterior ethmoidal air cells drain into the ethmoidal infundibulum area of the middle meatus. This whole complex is called osteomeatal complex (MCQ).
- Osteomeatal complex (OMC)-BE+ UP+ EI + 3 sinus openings.
- (BE- bulla ethmoidalis, UP-Uncinate process, EI-Ethmoidal infundibulum).
- It is also called Piccadili's circle.

SINUSITIS

Osteomeatal complex (OMC)

- Key pathology area in sinusitis is Osteomeatal complex (OMC)
- If Osteomeatal complex is blocked due to mucosal oedema.

Mucosal Edema
↓
Blockage of sinus drainage
↓
Collection of mucus in sinus
↓
Secondary Bacterial infection
↓
Sinusitis
↓
If persists > 3 months
↓
Chronic rhinosinusitis

Clinical Presentation of chronic rhinosinusitis

- Nasal obstruction.
- Purulent nasal discharge.
- Post nasal drip.
- Halitosis- bad smell from mouth.
- Hyposmia- decrease sense of smell
- Facial (Cheek) pain (in maxillary sinusitis)
- Headache.

- There are different types of headache/ facial pain indicative of different types of sinusitis (see the table below)

Types of headache/facial pain	Sinusitis
1. Office headache or periodic headache	feature of frontal sinusitis
2. Occiput or vertex headache	feature of sphenoid sinusitis
3. Pain at medial canthus	indicative of ethmoid sinusitis
4. Pain over cheek	indicates maxillary sinusitis

Sinusitis – investigations and treatment 00:18:43

- Investigations in a suspected case of sinusitis

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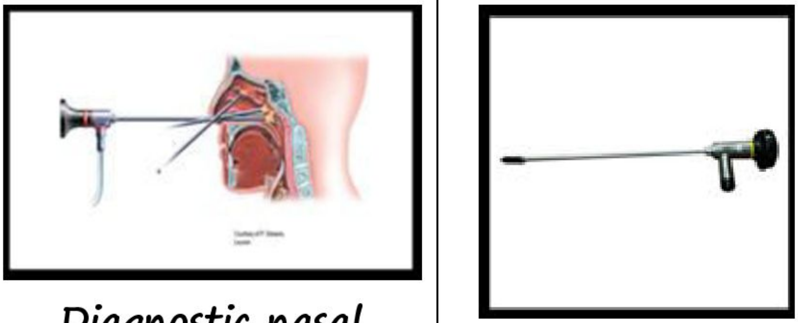
Diagnostic nasal endoscopy (DNE) 00:08:52

- 30- or 0-degree nasal endoscope is used in DNE.

There are three passes of nasal endoscope which are as follows	
1st pass	along Inferior turbinate
2nd pass	Above Middle turbinate
3rd pass	inside Middle Meatus

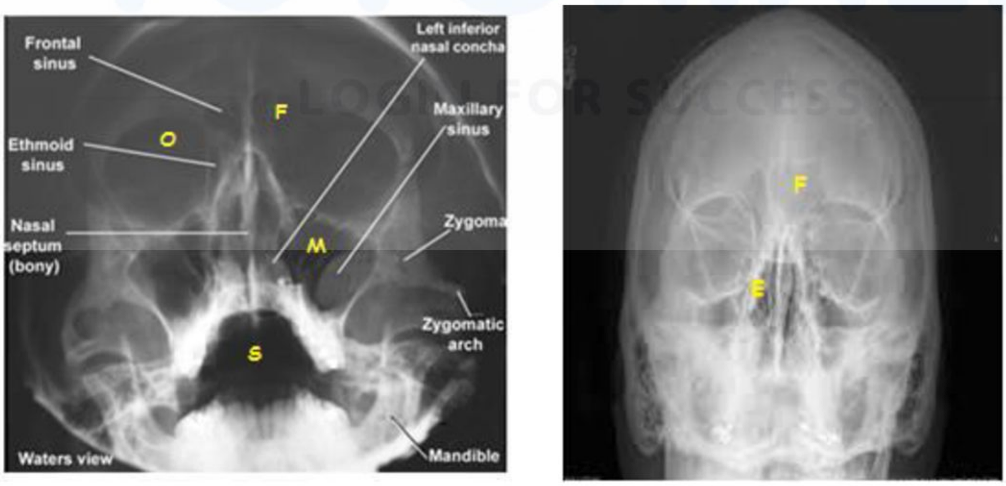


Diagnostic nasal endoscopy

0-30 degrees endoscope Fig: 1

X ray paranasal sinuses 00:11:06

- (WATERS VIEW) with open mouth
- This is the best x ray view for sinuses.
- Open mouth is to include sphenoid sinus in x-ray.
- It is OCCIPITOMENTAL VIEW.
- This x-ray view with open mouth is referred as Pierre's view as well. Water's view shows all the sinuses except posterior Ethmoid air cells.


Frontal sinus
F
Ethmoid sinus
O
Nasal septum (bony)
Left inferior nasal concha
Maxillary sinus
Zygoma
M
Zygomatic arch
S
Mandible
Waters view
F
E

Water's view

Caldwell's view

Fig: 2

- Lateral view for sphenoid sinus →

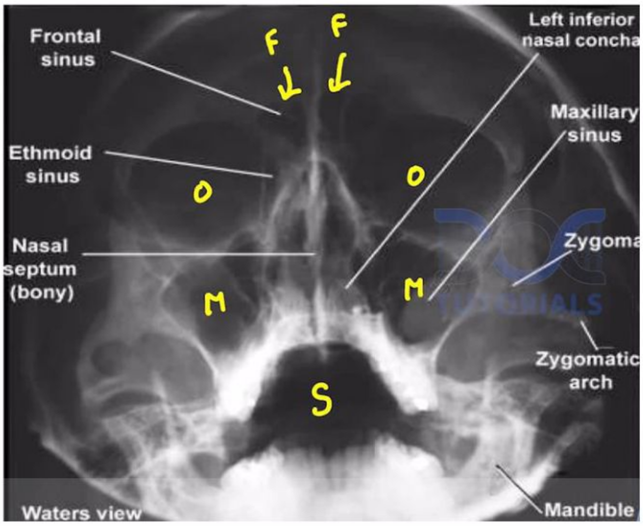

Frontal sinus
Ethmoid sinus
Nasal septum (bony)
Left inferior nasal concha
Maxillary sinus
Zygoma
Zygomatic arch
Mandible
Waters view
F
F
O
O
M
M
S

Fig: 3

Best x-ray view for different sinuses is as follows:	
Maxillary sinus	Water's view/ occipito mental view
Frontal and ethmoid	Caldwell's view/ occipito frontal view
Sphenoid	X ray skull lateral view.

Ct scan of paranasal sinuses

- It is best radiological investigation for sinuses.

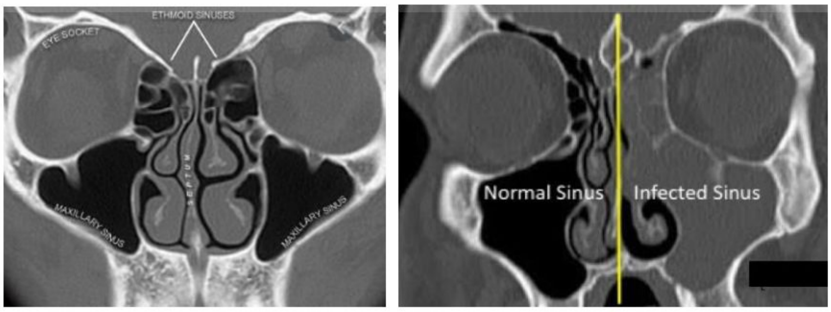

ETHMOID SINUSES
EYE SOCKET
SEPTUM
MAXILLARY SINUS
MAXILLARY SINUS
Normal Sinus
Infected Sinus

Fig: 4

- For fungal sinusitis, MRI is better investigation to rule out the invasion into surrounding tissues.

Treatment of chronic rhino sinusitis 00:20:21

- Antibiotic + decongestant for 3 weeks.
- If it fails to give relief, we do surgery called FESS.

Fess – functional endoscopic sinus surgery

- Main aim of FESS is to re-establish the sinus drainage.
- Ethmoidal Infundibulum is the opening where they drain (has 2 walls – bulla ethmoidalis and uncinate)

Steps of FESS-

- 1st step -UNCINECTOMY.
- 2nd step- REMOVING BULLA ETHMOIDALIS.
- Blake Sley – forceps is used to remove Bulla Ethmoidalis.

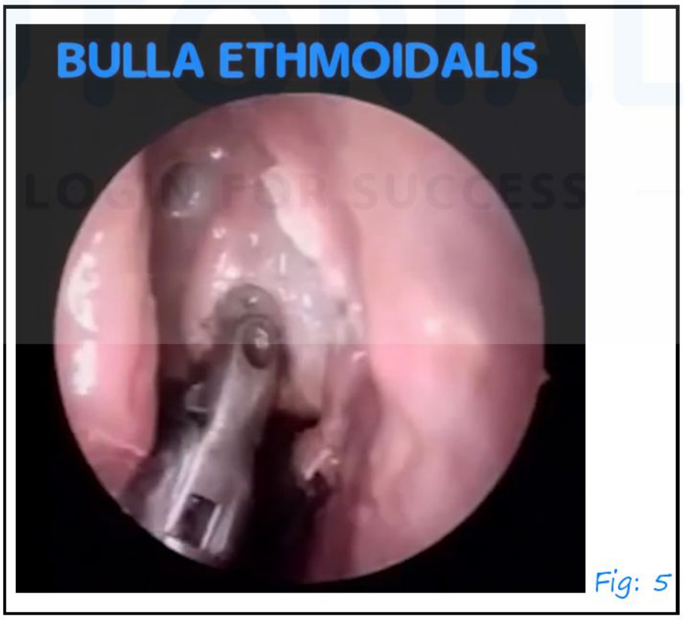
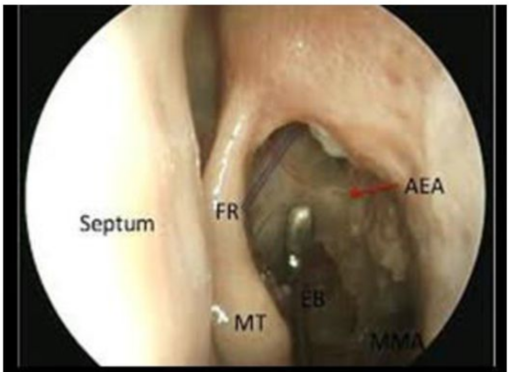


Fig: 5

- 3rd step – clearing other ethmoid air cells and sphenoid sinus drainage depending upon the extent of disease as seen on CT scan

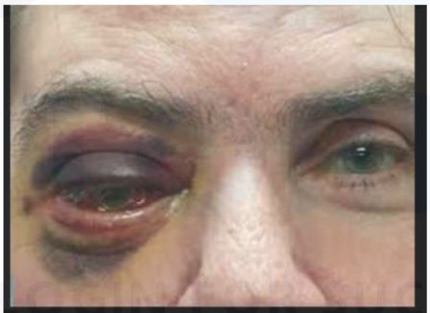


AFTER FESS - ENDOSCOPIC VIEW

Fig: 6

Complication of FESS 00:28:50

- Haemorrhage- clinically significant bleeding can be from anterior ethmoidal artery. This artery can retract back into orbit, which can lead to orbital hematoma.



ORBITAL HEMATOMA -

Fig: 7

- Orbital fat prolapses (injury to lamina papyracea) – yellowish mass prolapsing in nose from orbit during surgery.
- Stankevich sign – application of pressure on eye ball will herniate the orbital fat towards nasal cavity. (It is due to injury to lamina papyracea)
- Orbital fat prolapse which leads to enophthalmos.

- Injury to medial rectus muscle- this will lead to diplopia.
- Injury to cribriform plate- which will lead to CSF Rhinorrhoea. (Leaking of CSF into nose)

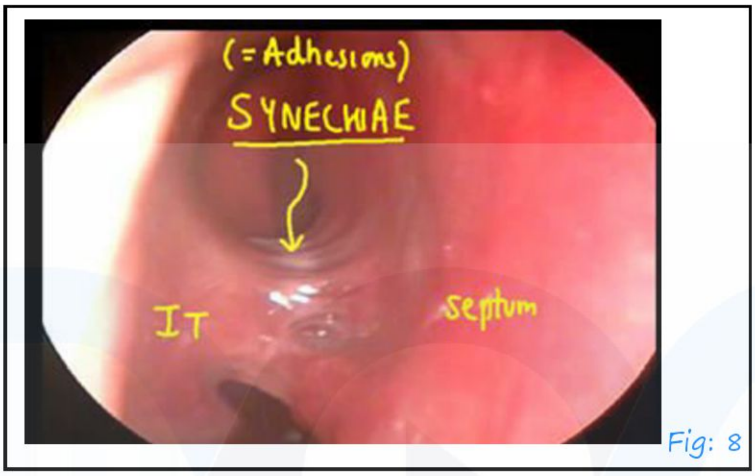


Fig: 8

- Most common long-term complication of FESS or any nasal surgery- is synechiae formation (adhesions).
- Prevention of synechiae formation is local application of MITOMYCIN C.
- This drug has anti fibroblastic action.

Complication of sinusitis 00:40:20

- Orbital infection- it is most commonly seen in ethmoid sinusitis. (Double chance as ethmoid bone is present between 2 orbits)

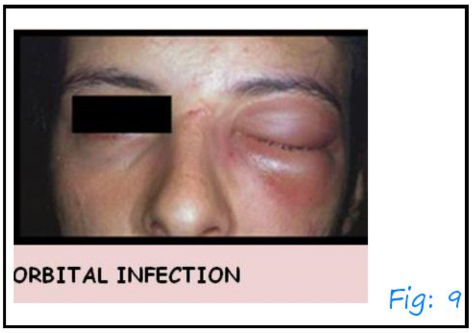


Fig: 9

Mucocele formation

- It is expansion of the bony wall of sinus due to retained mucus inside.
- Mucoceles are most commonly seen in frontal sinus and second common in Ethmoid sinus.

Mucocele of frontal sinus

- It is Non tender and cystic swelling.
- This has EGG SHELL CRACKLING FEEL.
- Eyeball is pushed forward, downward and laterally.

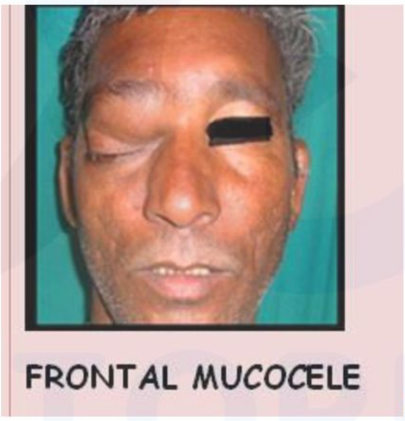


Fig: 10

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Mucocele of ethmoid sinus

- It presents as expansion of medial wall of orbit.
- This will Displace eyeball forward and laterally. (See images below)

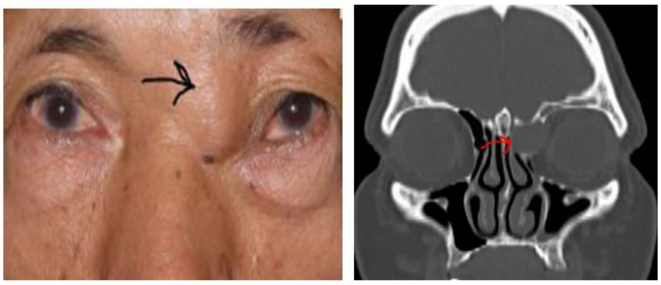


Fig: 11

Osteomyelitis

- It is seen when infection spreads from mucosa of sinuses into the bone.
- Maxillary osteomyelitis- more common in children.
- Frontal osteomyelitis - more common in adults. (Think about development sequence of M--E--S—F). Frontal sinus is not that significant in children in size. Frontal sinusitis will lead to frontal osteomyelitis which will lead to Sub- periosteal frontal abscess. This is called as Pott's puffy tumour.
- Pott's puffy tumour- it is not a tumour. It is given a pseudonym. It presents as Red, painful, forehead swelling.

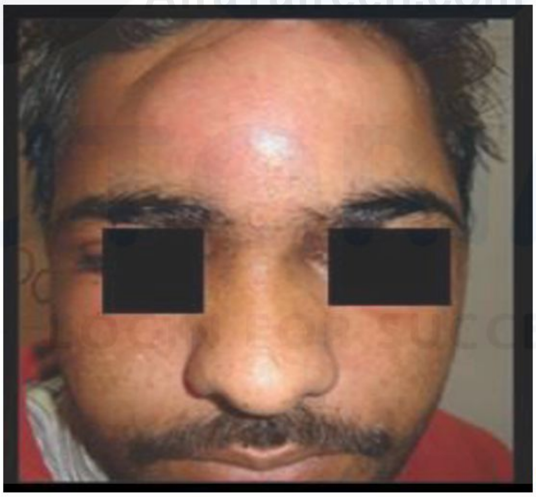


Fig: 12

Intracranial complications

- Sphenoid sinusitis → CAVERNOUS SINUS THROMBOSIS. → get a CT scan done urgently

NASAL POLYP

- It is defined as prolapsed, pedunculated and oedematous mucosa of sinuses. (Sometimes from nasal mucosa also).
- Etiology- Chronic infection or chronic allergy leads to chronic inflammation that will cause edema, this oedematous mucosa will eventually prolapse to from polyp.
- Chronic infection/allergy→ chronic inflammation → edematous mucosa→ prolapse to form polyp

Nasal polyp is of 2 types

- Antrochoanal polyp = It is also called KILLIAN'S polyp.
- It arises from maxillary sinus and grows posteriorly towards CHOANA. Therefore, it is better seen on a posterior rhinoscopy. This is done using posterior rhinoscopy mirror

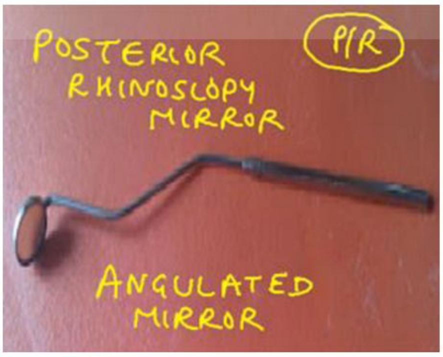


Fig: 1

- Cause - chronic infection (sinusitis)

- It is single in number, unilateral in origin and more common in children.

Chronic	Single
Unilateral	Children

- Antrochoanal polyp has 3 parts-
  - ANTRAL – arises from maxillary sinus
  - NASAL
  - CHOANAL – big mass in there in nasopharynx
- Chief complaint
  - It presents with nasal blockage and dull voice (this voice is called rhinolalia clausa)

Investigations

- Nasal endoscopy
- CT Scan of Nose & Paranasal sinuses (see image below)
- CT scan – homogenous mass

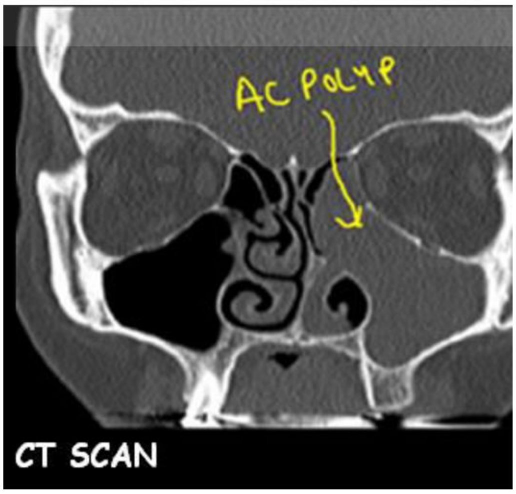


Fig: 2

- Treatment- Surgery --FESS or endoscopic polypectomy. Recurrence is less common in Antrochoanal polyp.

Clinical vignette.

- Q. If a 12-year-old male child presents with polypoidal mass in Nose.
- There are two diagnostic possibilities,
- Antrochoanal polyp.
- Angiofibroma.
- How to resolve this query? See the box below

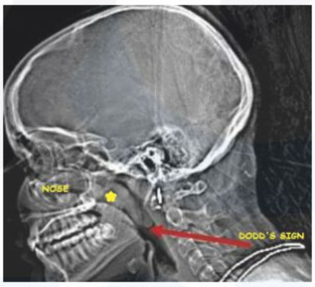


Fig: 3

- X ray soft tissue nasopharynx (lateral view) will show a crescent of air between the mass and posterior pharyngeal wall. This sign is called DODD 'S SIGN or CRESCENT SIGN.
- This sign is positive in Antrochoanal polyp, absent in angiofibroma

Ethmoidal polyp

- It is also called NASAL POLYP.
- They arise from ethmoidal air cells.
- Cause- chronic allergy.

- They are multiple in number, bilateral in origin and more common in adults.

Chronic allergy	Multiple
Bilateral	Adults

- Treatment of choice- Topical corticosteroid nasal spray. E.g., fluticasone, mometasone, budesonide etc.

RX - TOPICAL CORTICOSTEROID
NASAL SPRAY

Fig: 4

- If they fail, then we give oral steroids.
- If oral steroids fail, FESS is done (recurrence is very common)

Antrochoanal polyp	Ethmoidal polyp
Aka KILLIAN'S POLYP	NASAL POLYP.
arises from maxillary sinus	Arise from ethmoidal air cells.
Cause - chronic infection	Cause- chronic allergy.

single in number	multiple in number
unilateral in origin	bilateral in origin
common in children	Common in adults.

Systemic diseases associated with nasal polyp (ethmoidal) 00:09:12

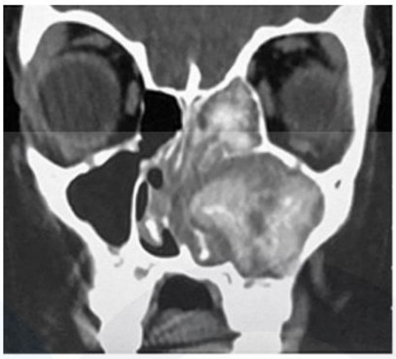
- Bronchial asthma (very common).
- Cystic fibrosis (most important for exam).
- Young syndrome
- KARTAGENER syndrome

Sampter's triad

- Nasal polyp (ethmoidal)
- Bronchial asthma.
- Allergy to NSAIDS (like aspirin).

ALLERGIC FUNGAL RHINOSINUSITIS AND MUCORMYCOSIS

Allergic fungal rhinosinusitis (AFRS) 00:00:30



Allergic fungal rhinosinusitis (AFRS) Fig: 1

- It is also called allergic fungal sinusitis
- It is seen in IMMUNOCOMPETENT PATIENTS.
- It is a combination of type I and type III hypersensitivity reactions.

Clinical picture

- Allergic nasal mucin, its features are:
  - It is very thick.
  - It has Peanut butter appearance.
  - Fungal hyphae seen on microscopy
  - It has Eosinophils & Charcot Leyden crystals seen on microscopy

Nasal polyp

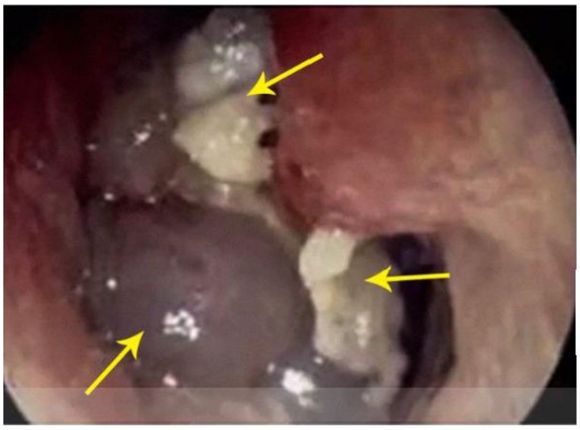
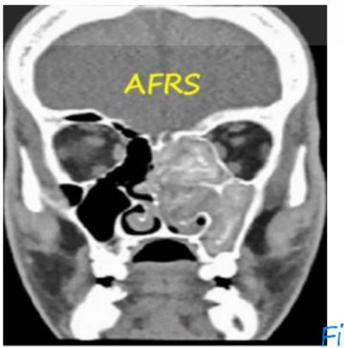
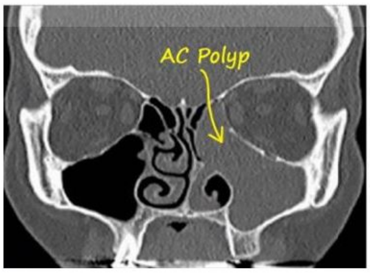


Fig: 2

- On CT scan the difference is as follows

DOC TUTORIALS LOGIN FOR SUCCESS

Fungal polyp (AFRS)	Normal polyp (Antrochoanal or ethmoidal polyp)
•Heterogeneous with double density appearance. (MCQ) •This appearance is due to fungal debris in the polyp.	• Homogeneous in appearance on CT scan (see the two images of CT given below and compare)
 Fig: 3	 Fig: 4

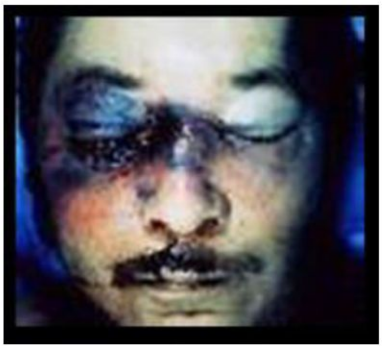
- In this case, MRI is also done to rule out invasion of surrounding tissues.
- MCQ/ which radiological investigation is best for fungal sinusitis?
- Answer – MRI> CT

Treatment

- FESS followed by ORAL STEROIDS.
- Antifungal agents are only given if there is any invasion of surrounding tissues seen on MRI scan.
- Bent and Kuhn criteria

Major criteria	Minor criteria
Type I hypersensitivity to fungi (confirmed by skin test or IgE Immuno CAP)	Bone erosion
Nasal polyposis	Charcot-Leyden crystals
Characteristic CT findings	Unilateral disease
Eosinophilic mucus without invasion into the sinus tissue	Peripheral eosinophilia
Positive fungal stain of sinus content removed during surgery	Positive fungal culture

Mucormycosis 00:13:20



Mucormycosis Fig: 5

- It is acute fulminant fungal sinusitis.
- It is more commonly seen in

  1.YOUNG DIABETIC

  2.HIV + PATIENT

  3.COVID 19 patients
- It is an infection of Nose and sinuses by MUCOR (RHIZOPUS) FUNGI.
- It is Angio invasive fungus. (it invades blood vessels)
- It can grow into orbit and brain. Hence, It is the Life threatening disease.
- It causes Ischemic necrosis of tissues. Hence, there is BLACKISH discoloration of tissues.

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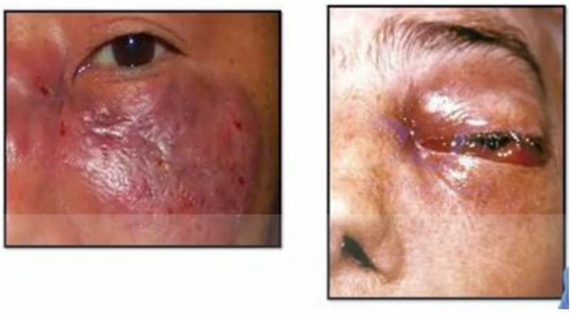
Clinical picture

- Early features
- Pain /numbness over cheek/Cheek swelling



Initial clinical picture Fig: 6

- Vision disturbance/Diplopia/swelling around eye
- Pain/Loss of upper tooth

Late features

- Blackish nasal mass.
- Blackish discoloration around the eye.

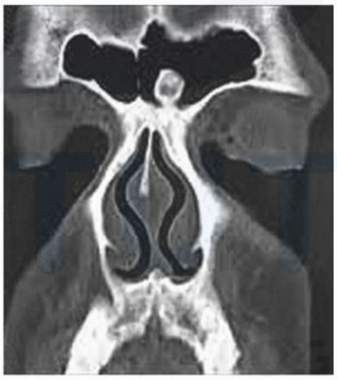
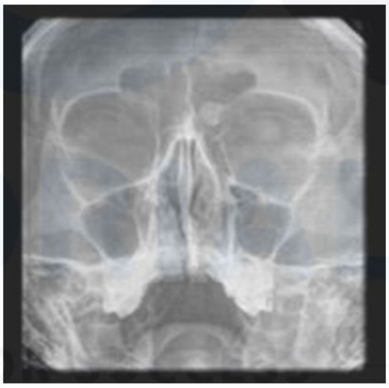
Investigation:

- Nasal endoscopy
- Koh smear
- Fungal culture
- Radiology - MRI Scan with contrast of paranasal sinuses with orbit
- Mucormycosis – Black turbinate sign on contrast MRI

NEOPLAMS OF NOSE AND PARANASAL SINUSES

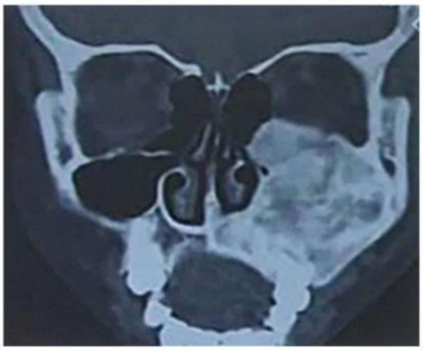
Osteoma 00:00:30

- MC benign tumour of sinuses is OSTEOMA.
- Osteomas are most commonly seen in frontal sinus followed by ethmoid sinus.
- Most of the time, Osteoma is incidental finding in frontal sinus on Xray/CT scan of paranasal sinuses
- They need treatment only if they are symptomatic. e.g.: Causing sinusitis due to mechanical blockage to drainage of sinuses.

	 Fig: 1
Ct scan showing **frontal sinus osteoma**	X-ray PNS showing **frontal sinus osteoma**

Fibrous dysplasia 00:02:18

- Bone is replaced by fibrous tissue; It is most commonly seen in Maxilla.
- On CT scan it has ground glass appearance. (See image)



Fibrous Dysplasia
ground Glass Appearance on CT scan

Fig: 2

Bleeding polypus of septum 00:03:40

- Most common benign tumour of the nasal cavity is capillary haemangioma of septum, also known as bleeding polypus of septum. Site of origin is LITTLE'S AREA on septum

Malignancy of sinuses 00:05:33

- Most common sinus involved is MAXILLARY SINUS> ETHMOID SINUS.
- Risk factor is occupational exposure to
  - Nickel –leads to squamous cell carcinoma.
  - Hardwood dust exposure leads to adenocarcinoma of ethmoid; it is also called WOODWORKER'S CARCINOMA.

Cancer of maxillary sinus 00:08:45

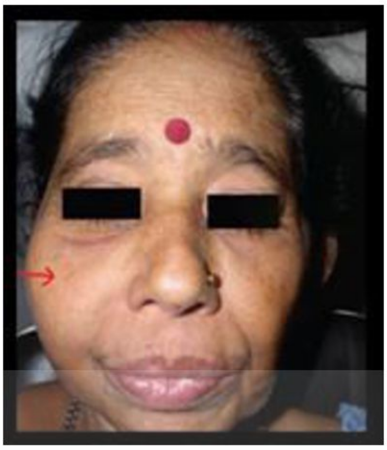


Fig: 3

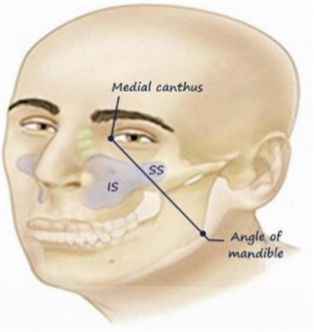
- Maxillary sinus is lined by mucosa from which the malignancy arises

Chief complaints

- Initially it gives vague symptoms stimulating
  - sinusitis. e.g. – nasal blockage, blood-stained nasal discharge.
- Late symptoms are as fallows
  - Nasal mass, epistaxis.
  - Cheek swelling.
  - Cheek anaesthesia, it is due to involvement of the INFRAORBITAL nerve. (MCQ)
  - Loss of upper teeth.
  - Proptosis and diplopia, due to orbital extension.

Ohngren's line & classification 00:14:01

For carcinoma maxillary sinus



Ohngren's Line Fig: 4

- This is an imaginary line from medial canthus to angle of mandible.
- It divides the maxilla into superstructure and infrastructure.
- Malignancy above this line has poor prognosis due to early orbital invasion.

Investigation

- CT scan
- Biopsy

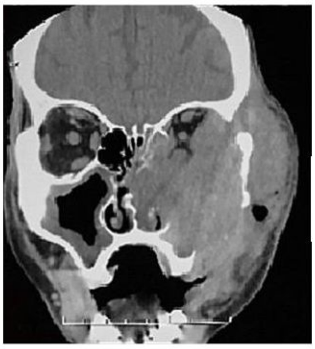
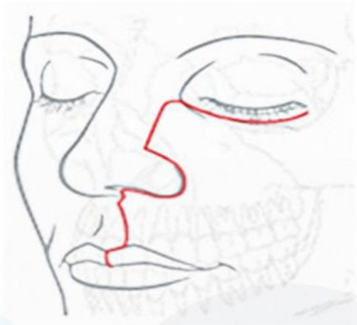


Fig: 5

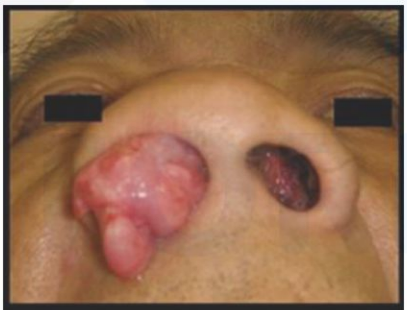
Treatment-

- Total maxillectomy by WEBER FERGUSSON approach +/- orbital exenteration followed by Radiotherapy.



Weber Fergusson incision Fig: 6

Inverted papilloma of nose 00:17:45



INVERTED PAPILLOMA OF NOSE Fig: 7

- It is also called RINGERTZ TUMOR or SCHINEDERIAN PAPILLOMA.
- It is more common in males.
- It is more common in 40 - 60 years of age.
- C/C-Fleshy polypoidal firm Nasal mass with epistaxis.
- In Inverted papilloma there is some role of HPV.
- It's Site of origin is the lateral wall of the nose.

- On histopathology examination – this papilloma is growing inwards (therefore it's called inverted papilloma, hence it is locally INVASIVE and it can show malignant change in 10% cases.)

Inward growth		
Called inverted	locally invasive	malignant change in 10%

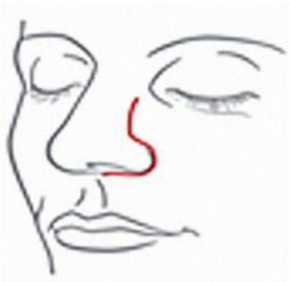
- C/C – Firm reddish nasal mass + epistaxis.

Treatment

- Nasal endoscopy
- KOH Smear
- Fungal culture
- Radiology

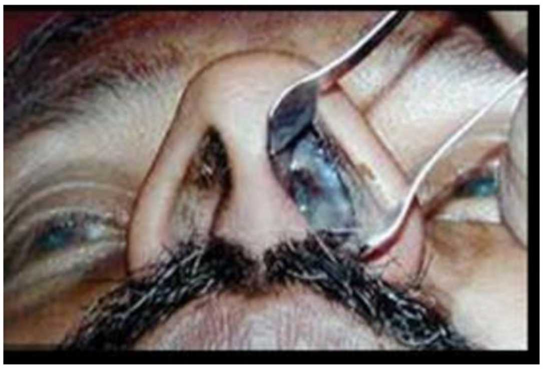
Treatment

- Surgery is called medial maxillectomy (because it is locally aggressive) by lateral rhinotomy approach using Moure's incision.



Moures Incision Fig: 8

Malignant melanoma of nose 00:25:11



SLATY GREY/BLUISH BLACK NASAL MASS

Fig: 9

- It is seen in 50-60 years of age.
- Site of origin is the nasal septum, particularly anterior part of septum.
- Examination shows SLATY GREY OR BLUISH BLACK nasal mass.
- Treatment- wide surgical excision, avoid chemotherapy and radiotherapy as immunological defence of the patient plays an important role.
- 5 years survival rate of this patient is 30%.

Esthesioneuroblastoma 00:26:14

- It is also called OLFACTORY NEUROBLASTOMA.
- It is a malignant tumour arising from olfactory epithelium.
- It has got bimodal age distribution.
- Examination shows FRIABLE CHERRY RED (Vascular) nasal mass in the upper 1/3rd of the nasal cavity.

- C/c - nasal obstruction and epistaxis.
- There is a high incidence of intracranial extension of this tumour.
- Treatment- surgery is craniofacial resection followed by radiation.

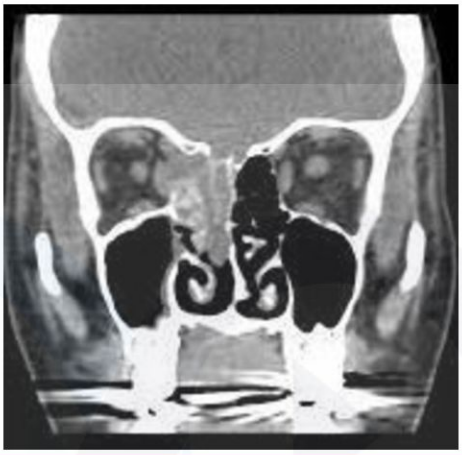


Fig: 10

ATROPHIC RHINITIS, RHINOCERICAL RHINOSPORIDIOSIS

Atrophic rhinitis 00:00:18

- It is also called OZAENA.
- It is progressive atrophy of mucosa, sub-mucosa and underlying bones of nasal cavity, (particularly turbinate's)
- It is more common in females.

Etiology

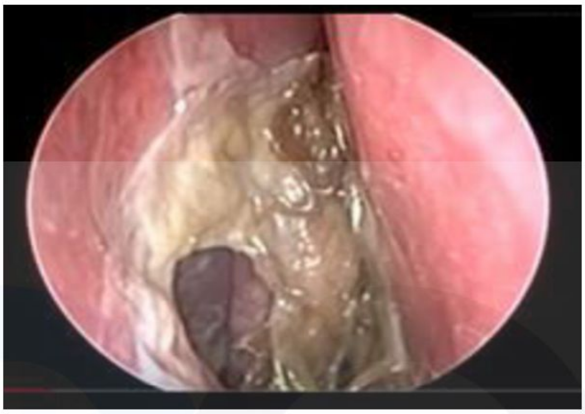
- Autoimmunity.
- Vitamin D deficiency.
- ESTROGEN deficiency. (As more common in females)
- Infection by Klebsiella ozaena.

TUTORIALS LOGIN FOR SUCCESS

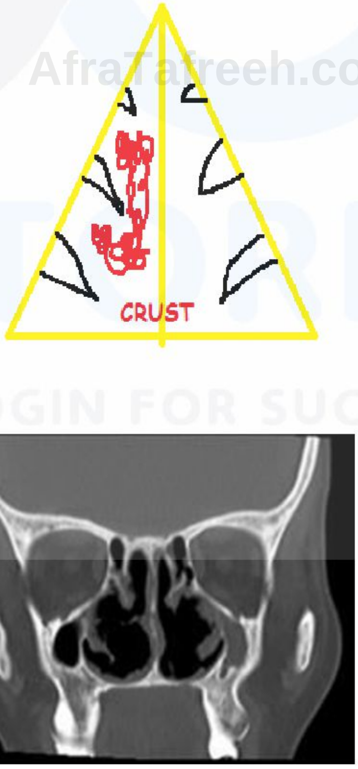
Examination

- Atrophied turbinate's (shrunken)
- Roomy nasal cavities, but nasal cavities are blocked by the CRUSTS. Crust means dried mucus. Crust is the hallmark of this disease. Crusts will lead to following symptoms:
  - Nasal obstruction.

- Bad smell from patient, but patient has Anosmia (loss of sense of smell). This is also called MERCIFUL ANOSMIA as patient can't sense their own bad smell.



Nasal crusting Fig: 1



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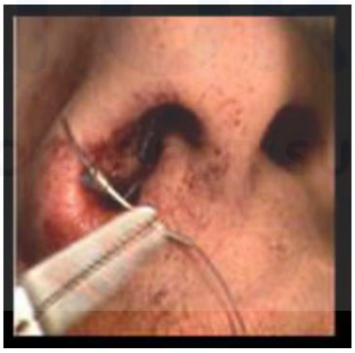
LOGIN FOR SUCCESS

CT atrophic rhinitis Fig: 2

- Anosmia is due to
  - There are atrophic changes in olfactory epithelium.
  - There is decreased airflow due to crusts.

Treatment

- Treatment of choice- Alkaline nasal douching (washing). It is done by dissolving alkaline nasal douching powder in water. This powder contains three agents-
  - Sodium bicarbonate – 1 part
  - Sodium biborate – 1 part
  - Sodium chloride – 2 parts
- Surgical treatment- 3 different surgeries can be done to treat atrophic rhinitis.



Modified young operation Fig: 3

a)Young's operation- it is a temporary complete closure of 1 nostril for 6 months and then open it and now do the same procedure on the other side. These days this is not a recommended surgery.

b) Modified young's operation- it is permanent partial closure of both nostrils at same time. It is done now a days.

c) Lautenslager's operation- it is mediatisation of lateral wall of nose by putting bone or silicon chips in lateral wall of nose.

Other treatment

- Kemicetine anti ozeana nasal drops. It contains three agents:
  - Vitamin D
  - Estradiol
  - Chloramphenicol. (MCQ)

Rhinoscleroma – woody nose 00:17:29

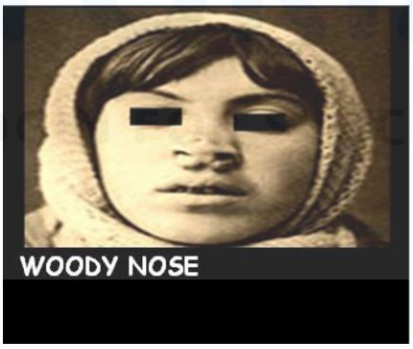


Fig: 4

- This is chronic granulomatous infection of nose.
- It is caused by Klebsiella rhinoscleromatis, also called Frisch bacillus.
- This is more common in Northern India. (States like U.P, Rajasthan)

- It has 3 stages of disease
- Atrophic Stage-it resembles atrophic rhinitis. It shows Atrophy of turbinate's, with crusts formation in nose.
- Granulomatous stage- it gives rise to hard external nose, which is called woody nose.
- Stage of fibrosis - it leads to disfigurement of the nose called tapir nose.
- Biopsy of Rhinoscleroma shows-
- Russell bodies- these are solid blue plasma cells like inclusion bodies.
- Mikulicz cells- they are large vacuolated cells.

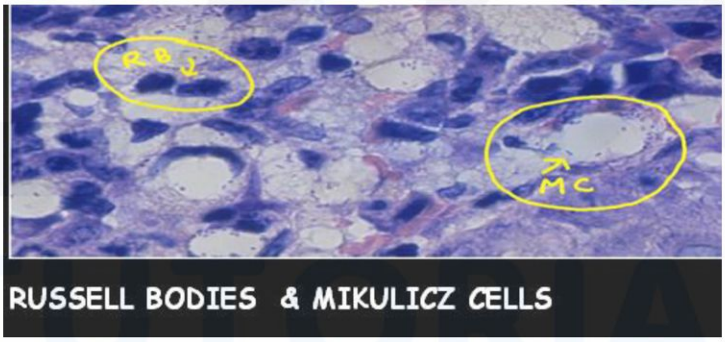
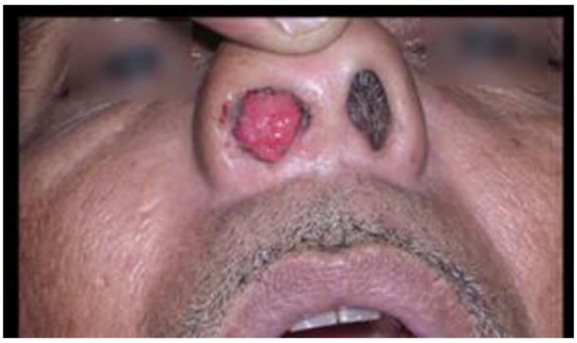


Fig: 5

- Treatment - DOC is tetracycline +streptomycin for 6weeks.
- Rifampicin is a 2nd line drug for Rhinoscleroma.

Rhinosporidiosis 00:25:23



Rhinosporidiosis Fig: 6

- Infection of nose caused by Rhino sporidium seeberi (an aquatic protozoa found in pond water)
- It is acquired by bathing in ponds
- It is more commonly seen in Southern India (states like Tamilnadu) It can involve the Nose (most common site), oral cavity, conjunctiva, Genital mucosa.
- Clinical- mulberry or strawberry like nasal mass with epistaxis. (It has irregularly studded surface) (not smooth like a polyp)
- Treatment- Surgical excision with electro cautery of base followed by Dapsone (to prevent recurrence).

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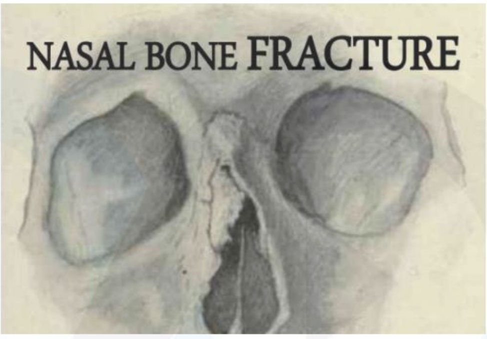
TUTORIALS
LOGIN FOR SUCCESS

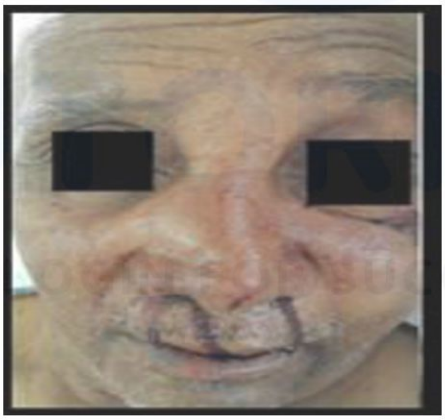
FACIAL TRAUMA

Nasal bone fracture 00:00:19

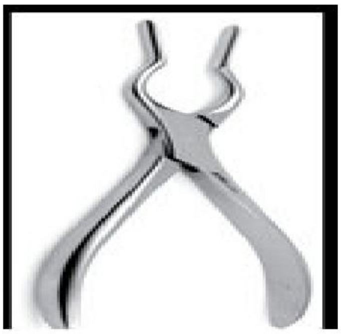
- This is the most commonly fractured bone in the face. There is history of trauma.
- Findings- Nasal deformity, Crepitus, Swelling may or may not be present.



Nasal bone fracture Fig: 1



Nasal deformity Fig: 2



Walsham forceps Fig: 3

- Investigation – x-ray nasal bones (Right and left lateral view)
- Treatment- immediate closed reduction before edema starts using WALSHAM FORCEPS.
- If edema is already present, then wait for 7 days for edema to subside and then reduce the fracture.
- Nasal bone is a cosmetic bone that needs absolute correction, for that edema should be subsided.

Nasal septum fracture 00:06:05

AfterTafreeh.com

Fig: 4

- It is of 2 types;
- If force is from front- horizontal fracture or JARJAVAY fracture.
- If force is from below- vertical fracture or CHEVALLET fracture.
- Treatment - septal reduction using ASCH forceps.

Zygomatic fracture 00:9:18

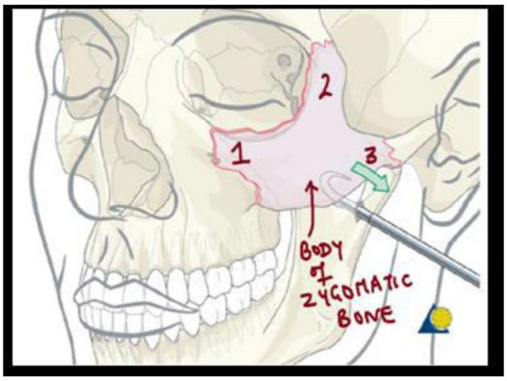


Fig: 5

- It is also called tripod fracture.
- This is the 2nd most commonly fractured bone of the face. zygomatic bones have three processes, so it is called tripod fracture
- C/P- (clinical presentation)
  - Flattening of malar eminence.
  - Trismus- it is a difficulty in mouth opening.
  - Step deformity of infraorbital margin.
  - Diplopia – due to entrapment of extra-ocular muscle in fracture line
  - Cheek anaesthesia- it is due to injury of infraorbital nerve.
- Investigation- X ray view - waters view.

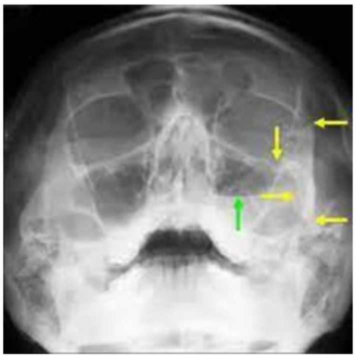


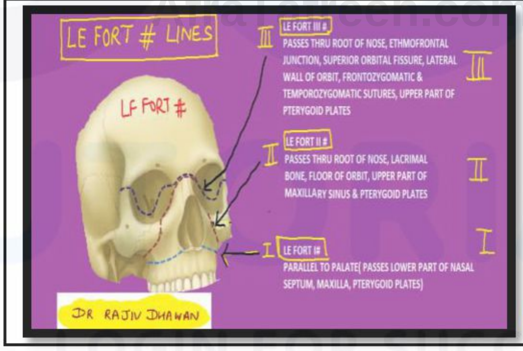
Fig: 6

- Treatment- if bone is not displaced, no treatment is needed.
- If the bone is displaced then open reduction and internal fixation should be done.

One Applied anatomy question

- Anaesthesia of cheek due to injury/involvement of infraorbital nerve is seen in following situations
  - Zygomatic fracture.
  - Maxilla fracture.
  - Cancer of maxillary sinus.

Mid face fracture 00:17:38



LE FORT III #
PASSES THRU ROOT OF NOSE, ETHMOFRONTAL JUNCTION, SUPERIOR ORBITAL FISSURE, LATERAL WALL OF ORBIT, FRONTOZYGOMATIC & TEMPOROZYGOMATIC SUTURES, UPPER PART OF PTERYGOID PLATES

LE FORT II #
PASSES THRU ROOT OF NOSE, LACRIMAL BONE, FLOOR OF ORBIT, UPPER PART OF MAXILLARY SINUS & PTERYGOID PLATES

LE FORT I#
PARALLEL TO PALATE(PASSES LOWER PART OF NASAL SEPTUM, MAXILLA, PTERYGOID PLATES)

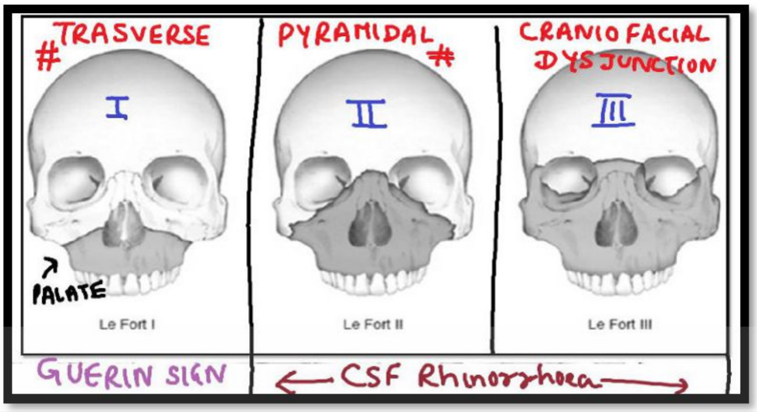
Fig: 7

TUTORIALS LOGIN FOR SUCCESS

There are of 3 types of Mid Face factures:

- LE FORT I =TRANSVERSE FRACTURE
- It passes along the palate. This leads to
  - floating palate.
  - Ecchymosis on palate this is called Guerin sign.
- LE FORT II – also called pyramidal fracture.
- LE FORT III – also called craniofacial disjunction.

- LE FORT II & III passing through the base of the skull so there is a possibility of CSF Rhinorrhoea.



# TRASVERSE
PYRAMIDAL #
CRANIO FACIAL DYS JUNCTION
I
II
III
PALATE
Le Fort I
Le Fort II
Le Fort III
GUERIN SIGN
CSF Rhinorrhoea

Fig: 8

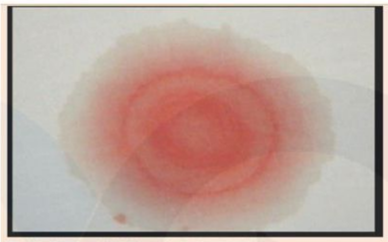
- Points to be kept in mind while MANAGEMENT OF FACIAL TRAUMA-
  - Airway management.
  - Bleeding
  - Other injuries. It may be a polytrauma case.

CSF rhinorrhoea 00:24:22

Fig: 9

- It is leakage of CSF from nose,
- Causes-
  - Most common cause- iatrogenic
  - e.g. - during FESS. This CSF leak is mostly due to injury to CRIBRIFORM PLATE.

  - Head injury – skull base fracture e.g. – NASOETHMOIDAL FRACTURE, LE FORT II & III fracture. This is called a traumatic CSF leak, this leak is blood mixed CSF, and therefore on filter paper it gives target sign or HALO sign or double halo sign. Most common site of traumatic leak is FOVEA ETHMOIDALIS (roof of Ethmoid).



TARGET SIGN -HALO SIGN Fig: 10

  - Brain tumours.
  - Spontaneous (raised ICP) CSF leak.

- Site– OVER ALL most common site of CSF rhinorrhoea is cribriform plate.
- Most common site of traumatic CSF leak is FOVEA ETHMOIDALIS.

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To confirm diagnosis

- CSF is non-sticky like water (HANDKERCHIEF TEST)– take a piece of cloth and put the leaking fluid on it and let it dry, if cloth turns hard after drying it is nasal discharge, CSF is like water so, after drying cloth will be soft.
- Patient cannot sniff back CSF.
- Biochemical analysis.

- Best confirmatory test is BETA -2 transferrin estimation (which is immune electrophoresis).

Test to find site of leak

- Best radiological investigation is HRCT Skull base.
- MRI (T2 images).
- CT cisternography (it is invasive dye test).
- Nasal endoscopy.
- Intrathecal Fluorescein dye injection

Treatment

- Rx of choice- Conservative (for 7 - 10 days) with the following
- Bed rest
- Antibiotics
- Elevate the head.
- Cough suppressants.
- Stool softeners.
- But if the leak doesn't stop then surgical repair of the leak site is done. There are 2 approaches:
- Neurosurgery approach -do it by open approach.
- Endoscopic Endonasal approach by ENT.

NASAL SEPTUM & DISORDERS

Nasal septum 00:00:15

- Nasal Septum makes medial wall of nasal cavity

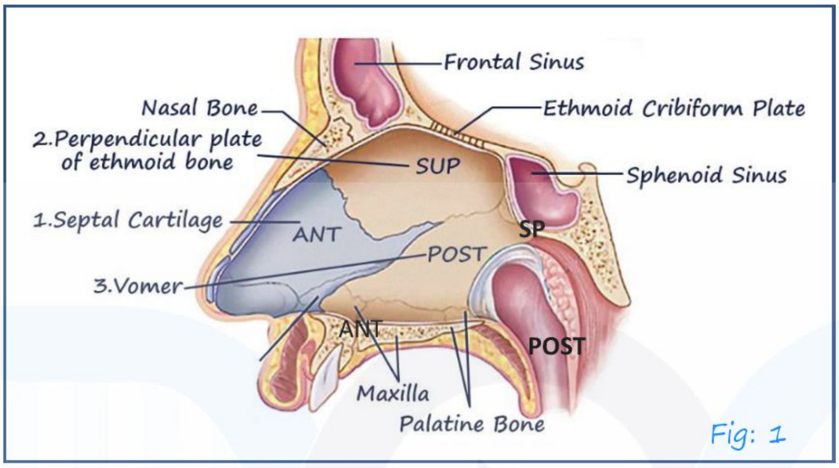

Frontal Sinus
Nasal Bone
Ethmoid Cribiform Plate
2.Perpendicular plate of ethmoid bone
SUP
Sphenoid Sinus
1.Septal Cartilage
ANT
SP
POST
3.Vomer
ANT
POST
Maxilla
Palatine Bone

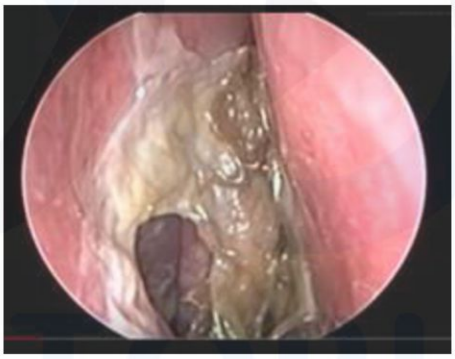
Fig: 1

Structures contributing to nasal septum are

- 3 Major structures-
  - Quadrangular or Septal cartilage (anterior most part).
  - Perpendicular plate of Ethmoid (superior part).
  - VOMER bone (posterior part).
- 4 Minor structures
  - Spine of maxilla
  - Spine of frontal bone
  - Rostrum of sphenoid
  - Crest of palatine and maxillary bones.

Deviated nasal septum (DNS) 00:06:42

- It can lead to different clinical outcomes-
- It can be ASYMPTOMATIC sometimes.
- It can cause nasal obstruction on the deviated side.
- It can cause crust (dried mucus) formation on the patent side due to increased airflow.
- Therefore, there is compensatory inferior turbinate hypertrophy on patent side. Inferior turbinate hypertrophy (ITH) gives MULBERRY appearance of nasal mucosa. (MCQ)



Nasal crusting Fig: 2

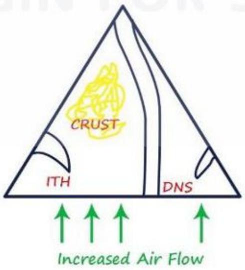
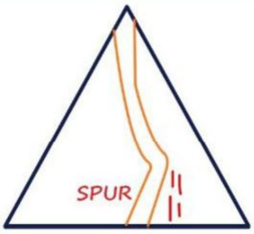


Fig: 3



Spur with epistaxis Fig: 4

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- It can lead to SPUR formation. (VIVA)SPUR is a sharp angulation on nasal septum. SPUR may lead to epistaxis.
- DNS can cause sinusitis.
- It can cause HYPOSMIA.
- External nasal deformity.
- Headache- it is due to contact between DNS and middle turbinate which can lead to neuralgic headache (MCQ). This is called sledder's neuralgia or anterior ethmoidal neuralgia.
- Treatment- surgery called Septoplasty. It is a conservative surgery in which only deviated parts of cartilage and bone are removed.
- Septodermoplasty- it is surgery done to prevent recurrent epistaxis in RENDU OSLER WEBER DISEASE (Hereditary Haemorrhagic Telangiectasia). In this surgery we replace septal mucosa with skin to prevent recurrent epistaxis.

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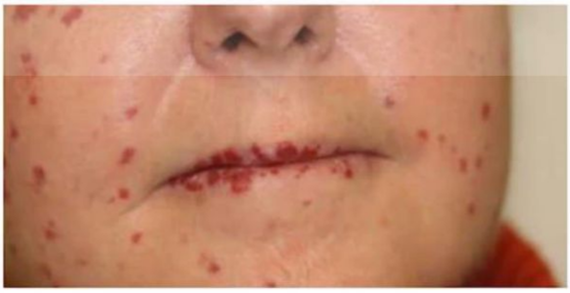

Fig: 5

Septal haematoma 00:22:30

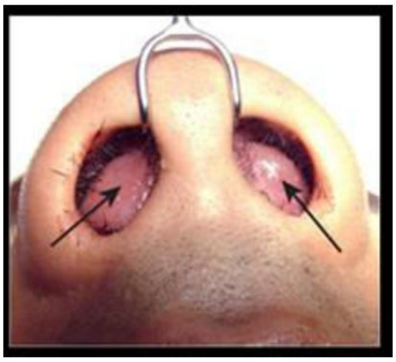

Fig: 6

- Cause - cause is trauma
- It is bilateral entity.
- Clinical- After Trauma, patient complains of
  - Nasal swelling.
  - Bilateral nasal blockage.
- Treatment- immediate aspiration or drainage of hematoma, otherwise it will lead to septal abscess which will cause septal perforation

Septal perforation 00:26:45

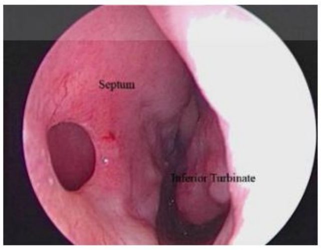

Fig: 7

- Causes-
  - Trauma (septal haematoma --- septal abscess--- septal perforation)

- Septal surgery.
- Cocaine snorting – extensive vasoconstriction leads to perforation.
- Chronic Granulomatous diseases e.g.

Tuberculosis	Perforation of cartilaginous part.
Lupus	Perforation of cartilaginous part.
Leprosy	Perforation of cartilaginous part.
Syphilis (tertiary syphilis) (MCQ)	Perforation of bony part
Wegener's granulomatosis	Perforation of bony & cartilaginous parts

- C/C–
  - Whistling sound.
  - Crust formation. (because of dryness)
- Treatment– surgical closure of perforation using–
  - Septal buttons (obturator) which are made of Silastic.
  - Local flap rotation.

Septal Button/Obturator

Fig: 8

OLFACTION

- It is sense of smell.
- Olfactory epithelium lines upper 1/3rd of nasal cavity
- Olfactory epithelium is innervated by olfactory nerve fibres that pass through cribriform plate. (It is part of ethmoid bone).

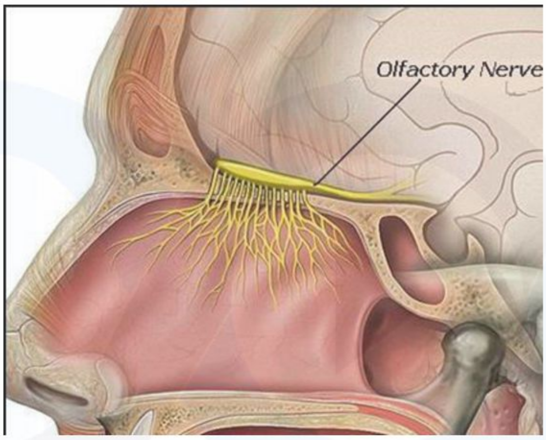

Fig: 1

Terminology

- Anosmia- loss of sense of smell
- Hyposmia- decreased sense of smell.

Causes of Anosmia/ Hyposmia

- Obstructive causes e.g.- nasal polyp, deviated nasal septum (DNS), inferior turbinate hypertrophy (ITH).
- Neurological causes- e.g.- head injury, diabetes, parkinsonism, and Alzheimer's disease, COVID-19 infection.
- Q. Kallmann syndrome- has 2 features

- Anosmia + Hypogonadism (infertility)

- Q. ANOSMIA & AMMONIA
  - A patient of anosmia can still sense Ammonia (NH3) because it is not a smell, it is an irritant. Ammonia is sensed through trigeminal nerve.
- Q. Which is the best test of olfaction?
  - Answer: UPSIT – (University of Pennsylvania smell identification test)

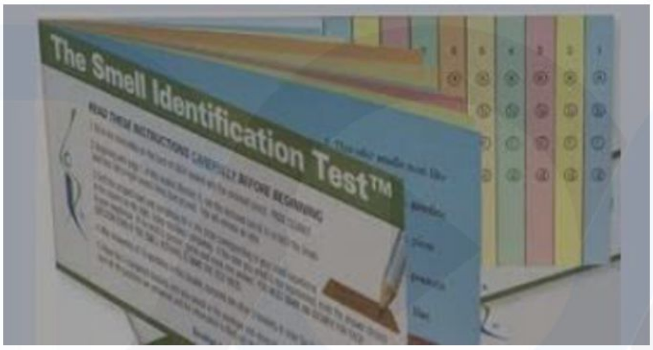

Fig: 2

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- Q. CACOSMIA & PAROSMIA
  - Cacosmia- perception of bad smell from one's own self, due to a cause. e.g. - dental infection.
  - Parosmia- it is a paranoid sensation or misinterpretation of smell as bad smell.
  - Causes of parosmia
  - In the recovery phase of Anosmia due to INFLUENZA.
  - Intracranial tumour.

Q. What is nasal cycle? 00:14:05

- Nasal cycle is natural/ normal rhythmic congestion and decongestion of two nasal cavities alternatively. It is a natural cycle.
- Duration of nasal cycle is 2.5 - 4.0 hours.
- Hence, at one time only one side nasal cavity is dominantly breathing
- How it happens--Inferior turbinate is a dynamic turbinate; it can change its size due to vasoconstriction and vasodilatation of sub-mucosal blood vessels

Acoustic rhinomanometry 00:17:13

- It is a new investigation used to record the following parameters:
- Total nasal airflow.
- Resistance to nasal airflow.

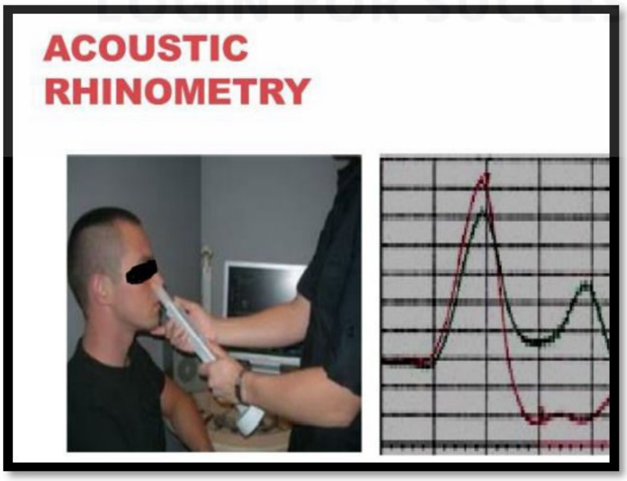

Fig: 3

BLOOD SUPPLY OF NOSE AND EPISTAXIS

Blood supply 00:00:40

- Blood supply of the nose is from 2 systems - nose has dual blood supply.

Up to middle turbinate	from ECA (External carotid artery)	80% of blood supply.
Above middle turbinate	from ICA (Internal carotid artery)	20% of blood supply.

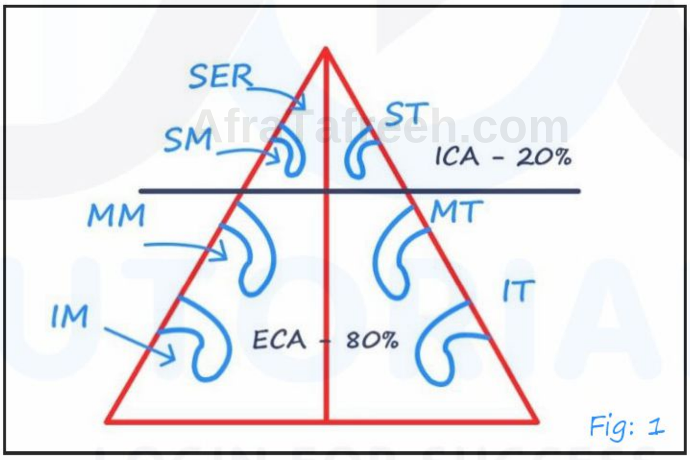

Fig: 1

Branches OF ECA & ICA

- ECA (External carotid artery)-
  - From Maxillary artery –
- Greater palatine artery (GPA)
- Sphenopalatine artery (SPA).
  - From Facial artery - Superior labial artery.
  - Artery of the epistaxis is the Sphenopalatine artery (SPA).

- ICA (Internal carotid artery)-
- From Ophthalmic artery –
  - anterior ethmoidal artery (AEA)
  - Posterior ethmoidal artery (PEA)

ECA

Maxillary artery
- Greater palatine artery ↓ GPA
- Sphenopalatine artery ↓ SPA

Facial artery ↓ Superior labial artery ↓ SLA

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Epistaxis 00:07:45

- Little’s area
- Most common site of epistaxis is LITTLE'S AREA.
- Location of epistaxis is anteroinferior part of nasal septum.
- Little's area is a highly vascular area.
- It contains the plexus called KIESSELBACH PLEXUS –

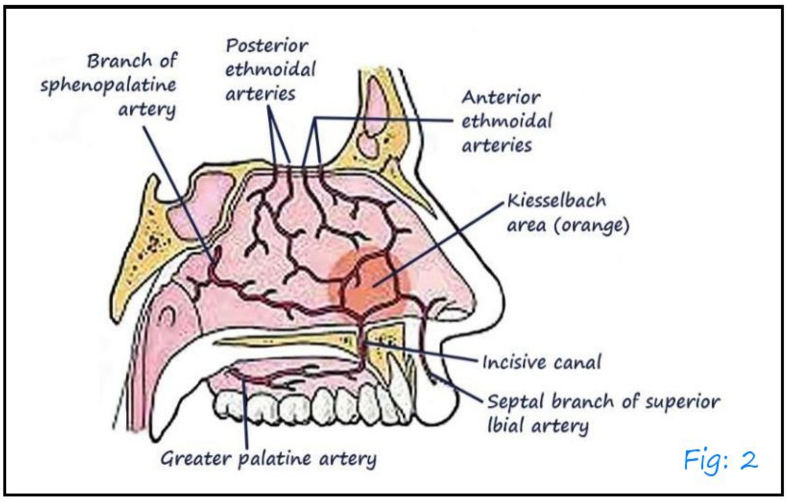
Branch of sphenopalatine artery
Posterior ethmoidal arteries
Anterior ethmoidal arteries
Kiesselbach area (orange)
Incisive canal
Septal branch of superior lbial artery
Greater palatine artery

Fig: 2

- 4 arteries contribute to form kiesselbach plexus-
- Greater palatine artery (GPA)
- Sphenopalatine artery (SPA)
- Superior labial artery (SLA)
- Anterior ethmoidal artery (AEA).
- (Q)Which artery does not contribute to kiesselbach plexus?

  Answer- Posterior ethmoidal artery (PEA).
- Little's area is also the site of origin of bleeding polypus of septum (capillary haemangioma)
- Another area for epistaxis is WOODRUFF PLEXUS.

WOODRUFF PLEXUS	KEISSELBACHS PLEXUS
• Venous plexus • Posterior part of nasal cavity. • Lateral wall, just above the posterior end of Inferior turbinate. • Less common site	• Arterial plexus • Anterior part of nasal cavity. • Septum, anteroinferior part • Most common site of epistaxis

- Most of the epistaxis is anterior epistaxis.
- In hypertension, posterior epistaxis is seen.
  - It is mostly severe epistaxis.
  - Posterior epistaxis is Difficult to control (stop bleeding).
  - It often needs a posterior nasal pack and hospitalization.

Causes of epistaxis 00:13:45

- Finger nail trauma or nose picking, it is the most common cause. It is seen in school going children.
- Accidental trauma (in young adults).
- Hypertension (in elderly) Posterior epistaxis. Most common source of bleeding is the Sphenopalatine artery.
- Bleeding disorders.eg. Haemophilia
- Haemorrhagic fever. Eg: dengue.
- Drugs- anticoagulant drugs.
- Angiofibroma and other neoplastic disorders of nose, sinuses and nasopharynx
- Nasal diseases or infection.
- Cirrhosis.

Management 00:19:20

- First aid- a. Pinch the nose for 3-5 minutes that supports coagulation in the little's area.

Trotters' method

- sit, leaning forward,
- spit the blood if it comes in the throat,
- and breathe through mouth
- Chemical cauterisation of a little's area with silver nitrate or carbolic acid or electro cauterisation.

- Topical application of decongestant. e.g.- xylometazoline, diluted adrenaline (it should be soaked in cotton and put that cotton in nose.
- Anterior nasal packing on both sides. Materials used are as follows-

PVA Nasal Packs
(Merocel)

Fig: 3

- Roller gauze soaked in liquid paraffin (approximately 1metre length, 2.5cm width for an adult patient),
- Nasal packing is done layer by layer on both sides so that adequate pressure comes to stop bleeding.
- PVA= POLYVINYL ACETATE (MEROCEL) nasal packs. Saline drops are added so that it gets swollen to give pressure (see image)

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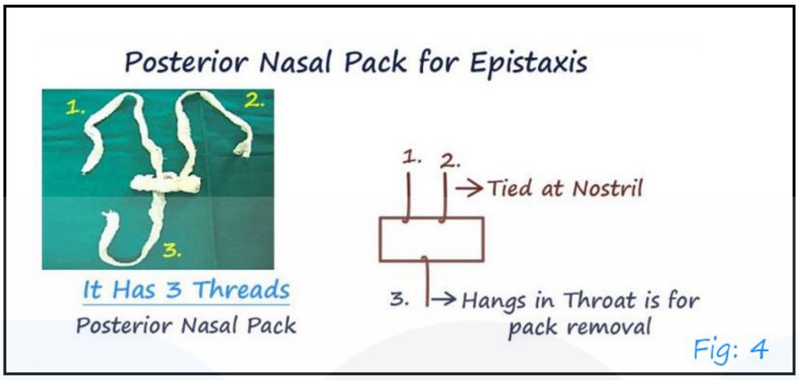
Posterior nasal packing

- It is placed in conjunction with anterior pack.
- It is a Major procedure done under general anaesthesia.
- It has three threads, two treads tied at the nostril and a single thread hangs in the throat for pack removal.

- In place of the posterior nasal pack sometimes Foley's (urinary) catheter can be used. It is not that efficient but sometimes it is used in place of conventional nasal packs.


Posterior Nasal Pack for Epistaxis
1.
2.
3.
It Has 3 Threads
Posterior Nasal Pack
1. 2.
→Tied at Nostril
3. →Hangs in Throat is for pack removal
Fig: 4

- Endoscopic examination of the nose to find the source of bleeding and electro cauterization of that area can be done.

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Artery ligation

- Endoscopic Sphenopalatine artery ligation (ESPAL).
- Maxillary artery ligation for uncontrolled bleeding in trauma cases.
- External carotid artery ligation in neck

ANATOMY Q.

- Q) How to differentiate ECA from ICA. When the neck is opened?
  - Answer: ICA has no branches in Neck, whereas ECA has many branches in neck. ECA stitch is

placed distal to origin of the first branch of ECA which is the superior thyroid artery.

- If the bleeding source is above middle turbinate or if ECA ligation fails then go for ETHMOIDAL ARTERY LIGATION(MCQ.)

MISCELLANEOUS TOPICS

Rhinitis medicamentosa 00:00:24

- Cause- prolonged use of topical decongestant nasal drops. e.g.- xylometazoline, oxymetazoline
- This leads to REBOUND CONGESTION.
- Treatment- Stop these drops + start steroid nasal spray.

Vasomotor rhinitis 00:03:27

- Vidian nerve- It is autonomic nerve supply to nose. It is also called the nerve of the pterygoid canal.
- Vidian nerve is made by combination of two Nerves-
- Greater superficial petrosal nerve. (Parasympathetic)
- Deep petrosal nerve. (Sympathetic)
- Parasympathetic over dominance can lead to disease called vasomotor rhinitis.
- Clinical Picture- on change of temperature, patient experiences
  - Itching in the nose.
  - Excessive watery rhinorrhoea. (No seasonal variation and serum IGE levels will be normal—it's not allergic condition)
  - Surgery- VIDIAN NEURECTOMY.

RHINITIS SICCA 00:8:07

- People who are engaged in work at higher temperatures. E.g. - bakers, blacksmiths.
- It involves the anterior part of the septum. There will be excessive crust formation on septum.
- Treatment- glycerol nasal drops. Glycerol is a hygroscopic agent which keeps the nasal cavity hydrated.

Nasal myiasis 00:10:23

- This is presence of maggots in nose or ear. Maggots are larvae of housefly (Chromia). Foul smelling conditions lead to myiasis.
- Treatment- maggot oil installation in the nose. + use mosquito net.
- Maggot oil contains chloroform + turpentine oil.

Myiasis Fig: 1

Angles of nose

- Naso frontal angle- normal is
- 115' -135'
- Naso - labial angle- normal is 90' - 110'

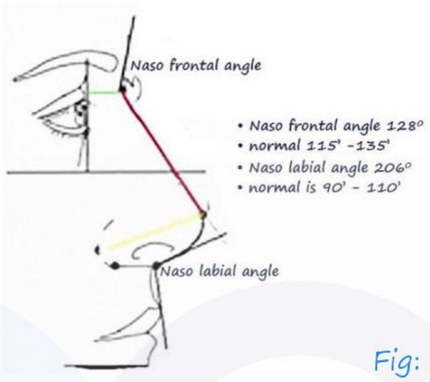
Naso frontal angle
• Naso frontal angle 128°
• normal 115' -135'
• Naso labial angle 206°
• normal is 90' - 110'
Naso labial angle

Fig: 2

Foreign body in nose 00:16:00

- This is more common in school age children,
- (MCQ) 7-year-old child presenting with unilateral, foul smelling nasal discharge and epistaxis.
  Answer - Foreign body in nose.
- Treatment- endoscopic removal in case of old foreign body

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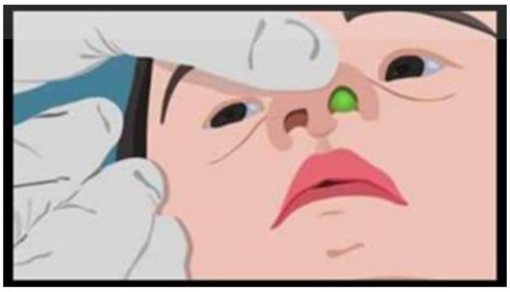
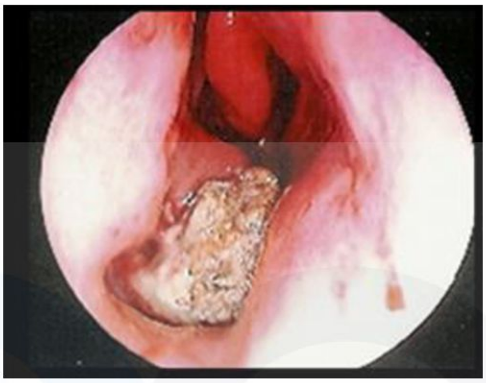


Foreign body in nose Fig: 3

- Disc battery should be urgently removed – they release alkali which can cause necrosis

Rhinolith 00:21:36



Rhinolith Fig: 4

- It is formation of Stone in the nasal cavity. It is more common in adults.
- It is made up of calcium carbonate, calcium phosphate, magnesium carbonate, magnesium phosphate.

C/C-

- Nasal blockage
- Epistaxis
- Foul smell from nose.
- Nasal pain.
- Headache.
- Treatment- endoscopic removal

EMBRYOLOGICAL DEVELOPMENT OF EAR

Embryological development of ear 00:00:36

Development of pinna 00:00:47

- Tragus of pinna develops from 1st branchial arch
- Rest of pinna develops from 2nd branchial arch.
- Incisura terminalis is the junction of 1st arch and 2nd arch.
- There is no cartilage in incisura terminalis. Therefore, LEMPERT'S ENDAURAL INCISION passes through incisura terminalis and enters the external auditory canal (see 2nd image below)

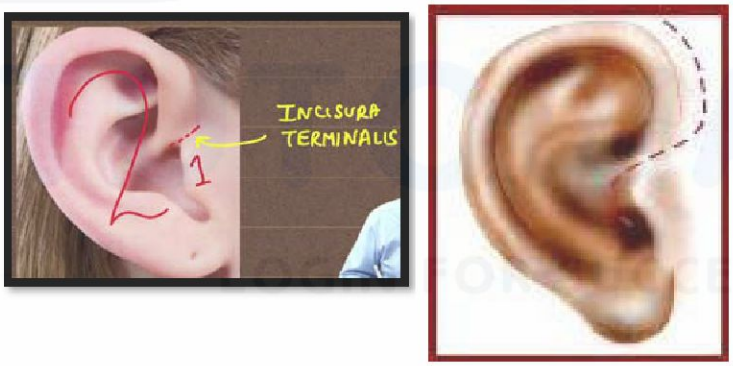


Fig: 1

Lampert endaural incision

Congenital disorders of pinna 00:5:50

Preauricular sinus 00:5:50

- If the union of 1st and 2nd arch is incomplete, it will lead to a congenital disorder called preauricular sinus

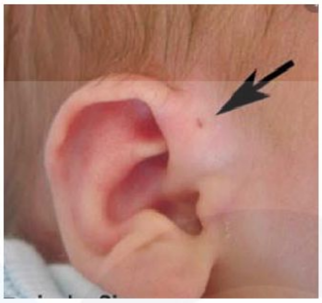
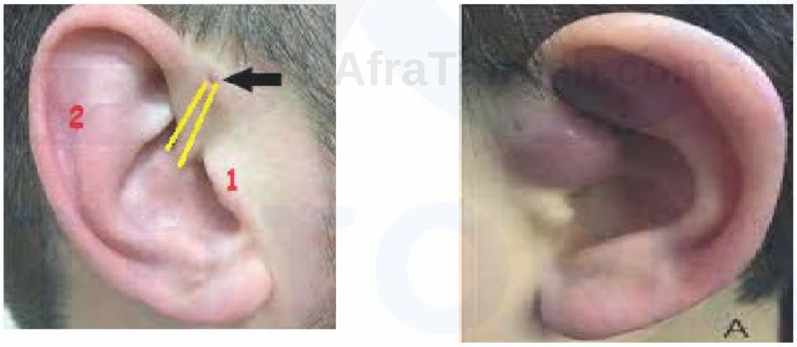


Fig: 2

- If asymptomatic, it needs no treatment



Preauricular sinus

Recurrent infection of sinus

Fig: 3

- If recurrent infection is there in pre-auricular sinus, surgical resection of tract is done
- Pinna development completes by the 20th week of embryological life

Hillocks of his 00:10:25

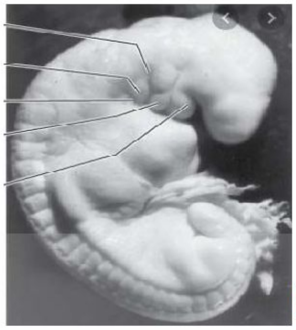


Fig: 4

- During embryological development of pinna, 6 elevations form on the head and neck are of embryo from 1st and 2nd arches which eventually fuse to form pinna.
- These 6 elevations are called hillocks of his (MCQ)

Fig: 5

Developmental defects of pinna 00:11:15

ANOTIA	MICROTIA
It is total absence of pinna	It is small pinna.

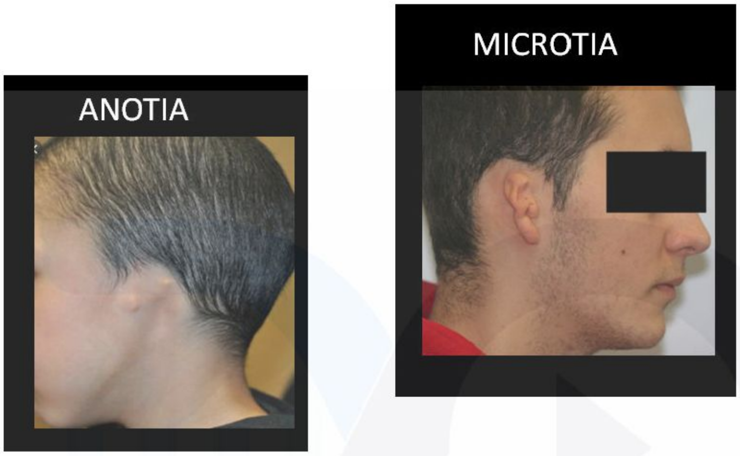


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Fig: 6

Helix and antihelix

- Normal pinna has 2 curvatures. Outer curvature is called as helix and inner curvature is called as antihelix.

What is Bat Ear?

- Normal pinna has 2 curvatures called HELIX (C) and ANTIHELIX(c).
- BAT EAR
  - If anti helix is absent, it is called BAT EAR.
  - Cosmetic surgery of pinna called Otoplasty.
  - It is done at 6 years of age. (Ideal age) as pinna attains adult size by this time

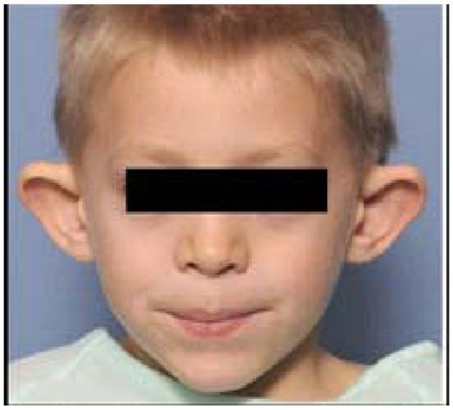
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Fig: 7

Other abnormalities in shape of pinna

- WILDERMUTH EAR-It is absence of curvature of helix, in this condition there is flat/ unfolded helix.
- MOZART EAR-it is a fusion of HELIX and ANTIHELIX.

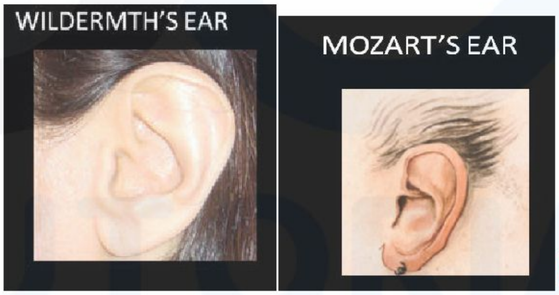


Fig: 8

- Darwin's tubercle → it is not a disease but just an anatomical variation. It is a conical elevation on helix

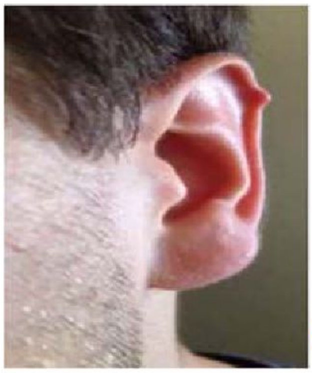


Fig: 9

Development of Other structures 00:20:30

External auditory canal (EAC)

- Derived from 1st branchial cleft.

Collaural fistula

- It has 2 opening, 1st in the EAC and 2nd opening is close to angle of mandible.
- Treatment: surgical excision.

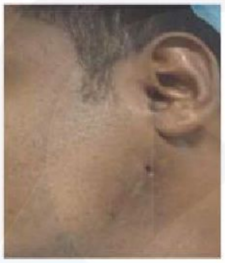


Fig: 10

Development of eustachian tube, middle ear 00:24:17

- It develops from 1st branchial pouch and is endodermal in origin.

Development of tympanic membrane 0025:48

- It develops from all 3 layers: ectoderm, endoderm, mesoderm

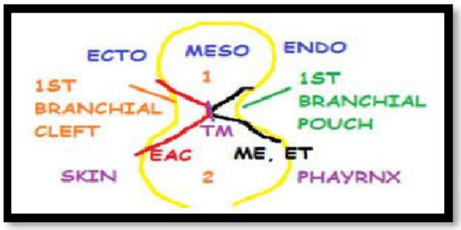

ECTO
MESO
ENDO
1ST BRANCHIAL CLEFT
1
1ST BRANCHIAL POUCH
TM
EAC
ME, ET
2
SKIN
PHAYRNX

Fig: 11

Development of ossicles 00:27:45

- Malleus and Incus develop from the 1st arch.
- Stapes- it has two sources of embryological development.
  - a. Head of stapes develop from 2nd arch.
  - b. Footplate of stapes develop from OTIC CAPSULE (neuroectoderm).
  - c. Footplate of stapes is attached at the oval window of cochlea.

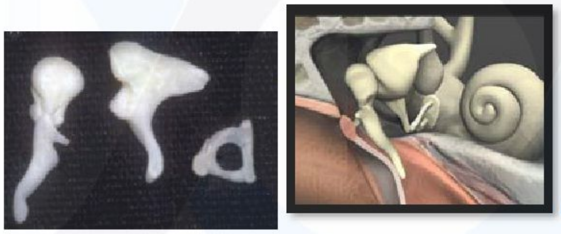


Fig: 12

Development of Cochlea 00:31:17

- Cochlea is also derived from OTIC CAPSULE
- Cochlea development completes by 20th week

Development of inner ear 00:32:25

- Otic capsule- has 2 divisions (neuroectoderm)
- Pars superior- gives origin to semi-circular canal and utricle.
- Pars inferior- gives origin to cochlea and saccule. (MCQ)

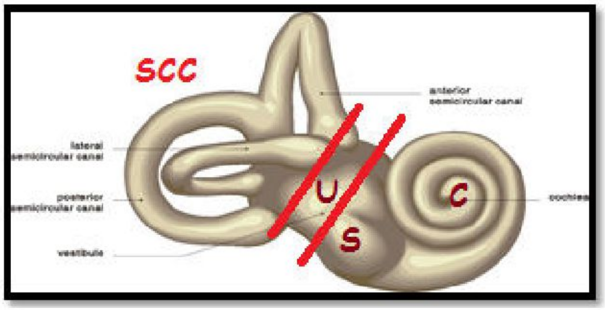

SCC
anterior semicircular canal
lateral semicircular canal
posterior semicircular canal
vestibule
U
S
C
cochlea

Fig: 13

Congenital anamoly of inner ear

- Most common congenital anamoly of inner ear is SCHEIBE'S COCHLEOSACCULAR DYSPLASIA
- MONDINI'S DYSPLASIA OF COCHLEA – here cochlea has only 1 ½ turn. It's a deaf child.

Treatment is cochlear implant

- MICHEL'S APLASIA OF COCHLEA – it's absence of cochlea.
- Treatment is a brainstem implant surgery

Q) Which Ear structures are of adult size at birth? (VIVA/MCQ)

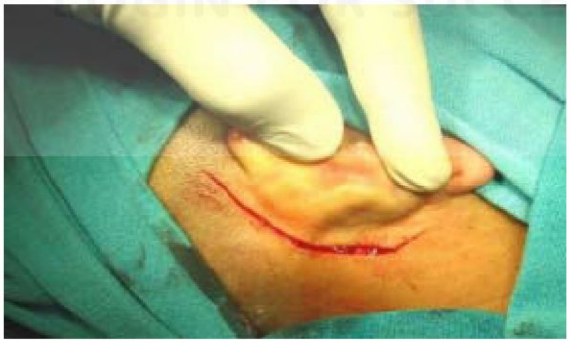
- Ans: -
  - – Middle ear
  - – Ossicles
  - – Cochlea.

Clinical anatomy 00:41:48

- Mastoid tip is absent at birth.
- It develops at 2 years of age. (MCQ)
- Stylomastoid foramen which is beneath the mastoid tip is the exit for facial nerve.
- Therefore, in children below 2 years of age the facial nerve lies very superficial. So, during ear surgery in patients of this age group, the conventional post aural incision should be avoided.
- In its place, Horizontal or oblique incision should be given. (VIVA)

The other incisions in ear surgery are 00:43:20

- Wilde's postaural incision, it is given 6 mm lateral to retro-auricular groove/ sulcus
- Post aural incision in children (<2yrs age) should be oblique/horizontal



Wilde's post-aural incision Fig: 14

MIDDLE EAR OSSICLES

Names:

- Malleus (hammer)(M)
- Incus (anvil) (I)
- Stapes (stirrup) (S)

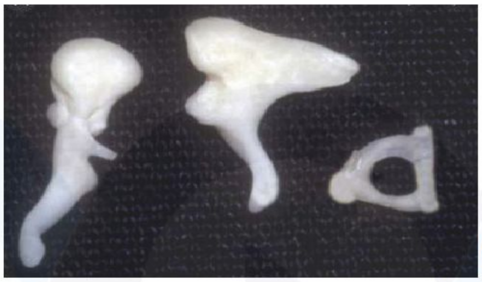


Fig: 1

- Size- Malleus >Incus >Stapes
- Stapes is the smallest bone in the body (S for stapes, S is small)

TUTORIALS
LOGIC FOR SUCCESS

Malleus 00:02:59

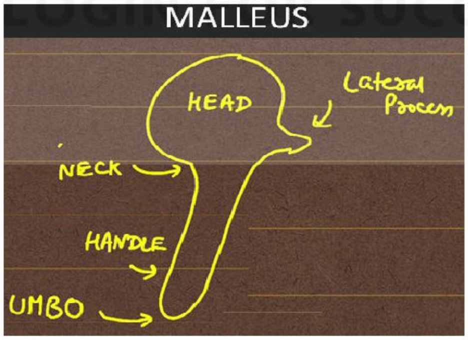

MALLEUS
HEAD
Lateral Process
NECK
HANDLE
UMBO

Fig: 2

- It has a hammer like shape.

Parts-

- Head of malleus,

- Lateral process, (outward), close to TM
- Handle of malleus
- Umbo (Tip of handle)

Incus 00:05:33

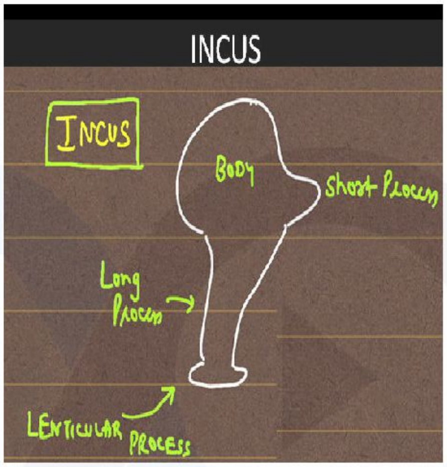

INCUS
INCUS
Body
Short Process
Long Process
LENTICULAR PROCESS

Fig: 3

Parts

- Body
- Short process of Incus
- long process of Incus
- Lenticular process (end of long process)

Stapes 00:07:24

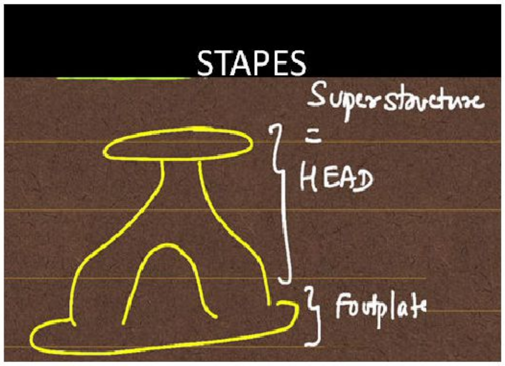

STAPES
Superstructure
=
HEAD
Footplate

Fig: 4

Parts

- Head or superstructure of stapes,
- Footplate of stapes. – it is attached at oval window of cochlea
- Stapes acts like a piston. If stapes is fixed, it will lead to disease called Otosclerosis.

Joints of middle ear 00:9:04

- Incudomalleal joint– Saddle joint (IM joint)
- Incudostapedial joint– Ball and socket joint. (IS joint)
- All joints of ENT are synovial joints.
- Cricothyroid and cricoarytenoid joints in larynx are synovial joints
- IM and IS joint in ear ossicles – synovial joint

Midde ear mechanics 00:11:17

- Stapes acts like a piston, if stapes gets fixed, it leads to otosclerosis.

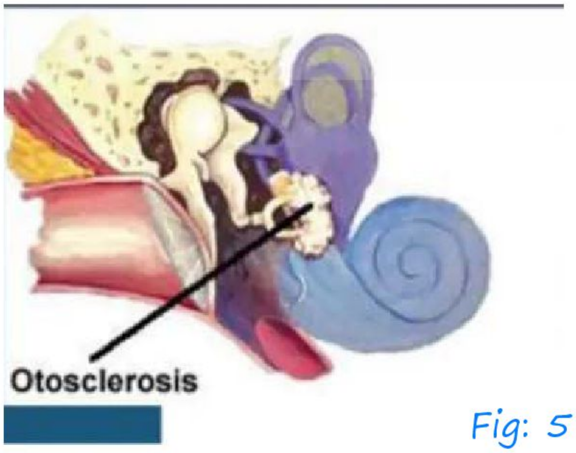


Fig: 5

Functions of middle ear 00:14:25

- Tympanic membrane and ossicles work as one unit.
- This assembly conducts sound energy to the inner ear.

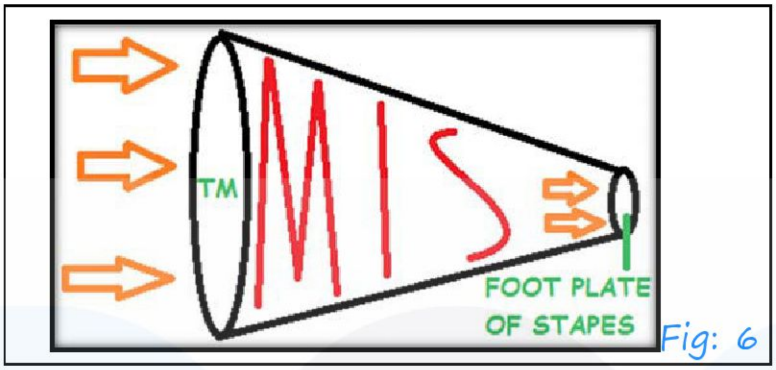


Fig: 6

- Middle ear also amplifies sound energy as the sound energy gets focused from a bigger area to a smaller area. (See image)
- This amplification factor is called Middle ear Transformer ratio which has further 2 components described below (Lever ratio and areal ratio)

Lever ratio

- Size of Malleus: Size of incus= 1.3: 1

Areal ratio

- Area of TM: Area of footplate of stapes = 17: 1
- 1 + 2 = MIDDLE EAR TRANSFORMER RATIO = 22: 1
- Main function of the middle ear is IMPEDANCE MATCHING MECHANISM. (This concept is described in ENT class app video)

TUTORIALS
GOAL FOR SUCCESS

PINNA

- Pinna is made of yellow elastic cartilage covered by skin.
- Skin is closely attached to cartilage on the lateral surface (front side)
- Skin is loose on the medial surface. (back side towards skull)

Fig: 1

Parts of pinna 00:2:10

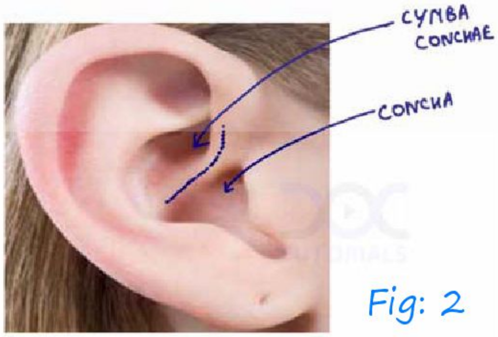


Fig: 2

Nerve supply of pinna- 5 nerves 00:5:53

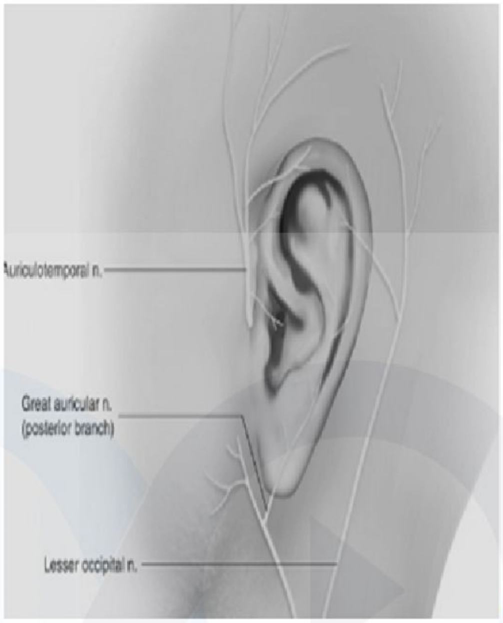
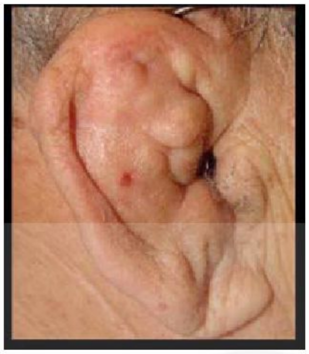

Auriculotemporal n.
Great auricular n. (posterior branch)
Lesser occipital n.

Fig: 3

- Greater auricular nerve. (Cervical Plexus-C2 C3)
  - It is the main nerve supply of pinna;
  - It also supplies lobules of pinna.
- Lesser occipital nerve- it supplies back of pinna (Cervical Plexus- C2)
- Auriculotemporal nerve. (Trigeminal Nerve)
- Auricular branch of vagus.
- Sensory division of facial nerve.
  - Auricular branch of vagus & Sensory division of facial nerve supply Concha of pinna. (4+5)
  - 3,4 & 5 nerves also supply External auditory canal

Disorders of pinna 00:12:35

Pinna haematoma 00:12:35



BOXER EAR Fig: 4

- It is due to trauma
- It is a sub-perichondrial haemorrhage.
- Treatment is aspiration or drainage + pressure bandage.
- Otherwise, it will lead to necrosis of cartilage, which leads to post traumatic pinna deformity called as BOXER EAR or CAULIFLOWER EAR

Keloid pinna 00:16:30

- Pinna can be a site of keloid
- It is most commonly found on helix.

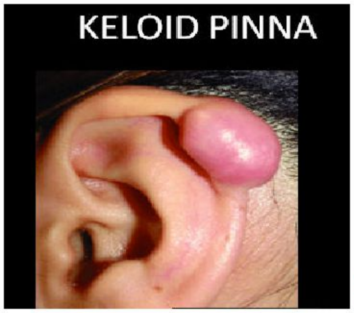


Fig: 5

Basal cell carcinoma 00:17:10

- Also called as rodent ulcer
- It presents as non-healing Ulcerative lesion on the pinna.
- BCC can also be on external nose

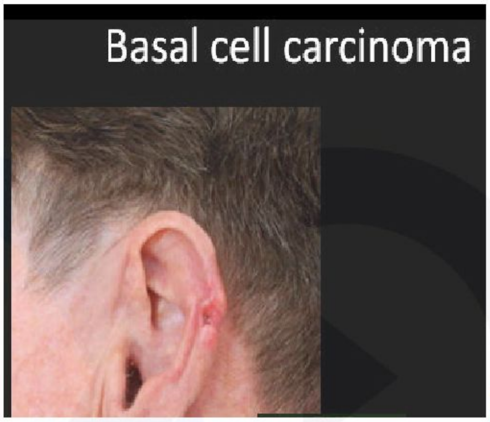

Basal cell carcinoma

Fig: 6

Gouty tophi of pinna 00:18:28

- Most commonly seen on helix of pinna.

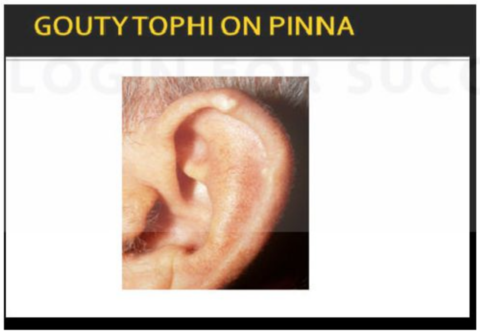

GOUTY TOPHI ON PINNA

Fig: 7

EXTERNAL AUDITORY CANAL EXTERNAL AUDITORY MEATUS (EAC/EAM)

- EAC is 24mm in length, outer 8mm is cartilaginous and inner 16mm is BONY.
- The bony EAC is made by a tympanic part of the temporal bone.

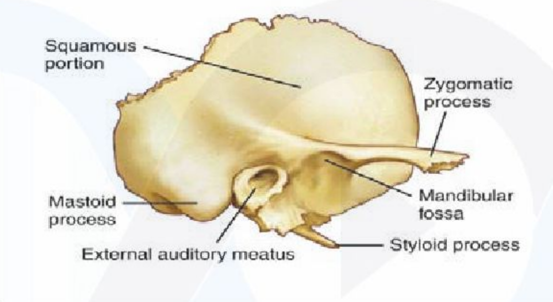

Squamous portion
Zygomatic process
Mastoid process
Mandibular fossa
External auditory meatus
Styloid process

Fig: 1

DOC TUTORIALS
LOGIC ... SUCCESS

Concept around Temporal bone and design of ear

- (Best described in Live class/APP video)

Fig: 2

- Pinna is the cartilaginous structure lying in relation to the temporal bone on the side of skull
- Tympanic, mastoid & Petrous Parts of temporal bone are related to ear
- Squamous part of the temporal bone has no relation to the ear

- All ear structure is designed by or are lying inside the temporal bone
- Facial nerve enters the ear via the internal auditory canal (IAC) on the Petrous aspect of temporal bone (see image below)

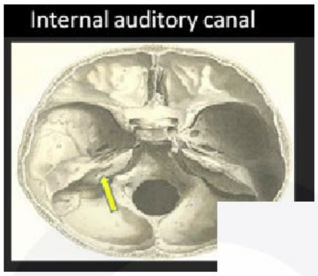


Fig: 3

- Basically, Ear is a journey from external auditory canal to internal auditory canal (EAC to IAC) via temporal bone.
- EAC is lined by skin. Outer part skin has hair follicles and CERUMINOUS = WAX glands which are modified APOCRINE GLANDS.

What is Keratosis Obturans?

- EAC skin sheds off to produce keratin inside EAC.
- EAC skin migrates outwards, bringing keratin and wax out of EAC.
- Rarely this skin migration pattern is absent, that will lead to collection of keratin + wax as an expansile mass in ear, this disease is called KERATOSIS OBTURANS. Treatment is surgery called CANALPLASTY.

WAX ISSUES

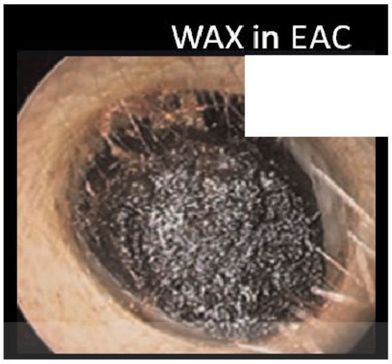


Fig: 4

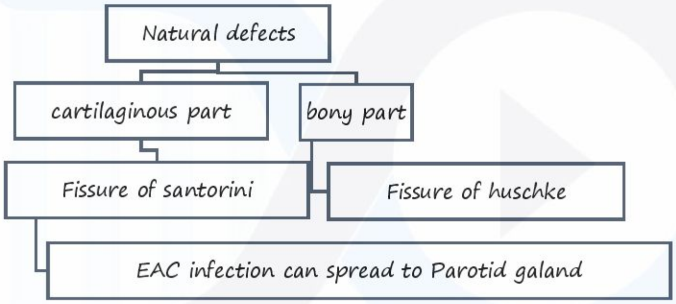
- Some people produce more wax which leads to EAC occlusion by wax collection. This will lead to conductive hearing loss (30 dB approx.)
- Treatment is PARADICHLOROBENZENE (wax dissolving drops), use these drops for a few days and the suction clearance or syringing is done.
- EAR SYRINGING- direction of water is Posterosuperior (MCQ)

Fig: 5

- Use water at room temperature. In syringing avoid cold water because it can lead to vertigo.

Natural defects in EAC 00:21:16

- There are some natural defects in EAC.
- In the cartilaginous part, they are called FISSURE OF SANTORINI.
- In the bony part, they are called FISSURE OF HUSCHKE.
- EAC infection can pass through this fissure of Santorini and infect the parotid gland.


Natural defects
cartilaginous part
bony part
Fissure of santorini
Fissure of huschke
EAC infection can spread to Parotid galand

Direction of EAC 00:23:23

- In children, it is nearly straight tube.
- In adults, direction is TORTUOUS. It is inward, downward and forward. Therefore, during ear examination/Otoscopy, pinna is pulled upwards outwards and backwards in adults. In children we only pull the lobule downwards.

[redacted] [redacted] [redacted] [redacted]

Fig: 6

- Any foreign lying body beyond isthmus can get impacted, which has to be removed by operatation under anaesthesia

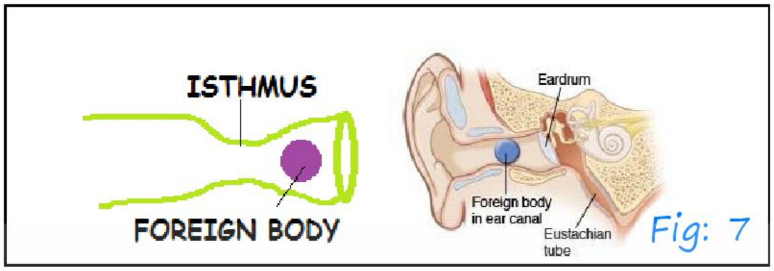

ISTHMUS
FOREIGN BODY
Eardrum
Foreign body in ear canal
Eustachian tube

Fig: 7

Insect in the EAC 00:25:56

- Treatment is to put oil in the EAC to kill it and then remove it.

Fig: 8

Sensory Nerve Supply of EAC 00:27:40

- There are three nerves

Auriculotemporal nerve	Anterior wall and roof of EAC
Auricular branch of the vagus It is also called ARNOLD's NERVE or ALDERMANN'S NERVE.	Posterior wall and floor of EAC Stimulation of this nerve leads to cough reflex. (MCQ)
Sensory division of the facial nerve also called the nerve of WRISBERG	Posterosuperior part of EAC.

DISEASES OF EAC 00:33:07

Diffuse otitis externa 00:33:19

- It includes infection of the complete skin of EAC and/or pinna.
- Most common organism to cause diffuse otitis externa is PSEUDOMONAS.
- Examination of EAC skin is red.
- Treatment is topical antibiotics ear drops.
- Diffuse otitis externa is also called SWIMMER EAR/ TROPICAL EAR/ SINGAPORE EAR/ TELEPHONE EAR.

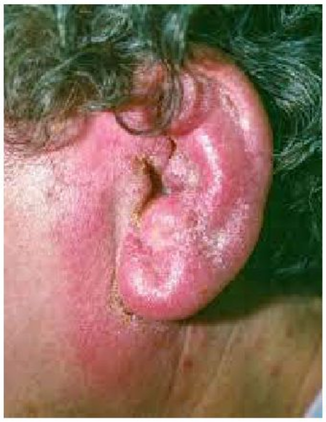


Fig: 9

Localised otitis externa / furunculosis (boil)

00:34:19

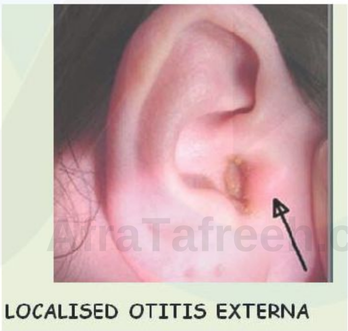


Fig: 10

- It is a staphylococcal infection of hair follicle
- It is seen in the outer part of EAC
- In this patient TRAGAL SIGN is positive. (if we touch tragus, pain is seen i.e. tragus tenderness)
- Treatment is I&D followed by IG packing (ICHTHAMMOL - antiseptic, GLYCERINE - reduces edema)

Malignant otitis externa 00:37:10

- It is infection of the underlying bone of EAC.
- It is also called as skull base osteomyelitis.
- It is a life-threatening infection, therefore called malignant otitis externa.
- It is seen in elderly diabetic patients (60-70 years.) / Immunocompromised.
- It is caused by Pseudomonas.

Clinical Picture

- Severe ear ache.
- Blood-stained ear discharge.
- +/- facial nerve palsy (it is the most commonly involved nerve).
- +/- 9,10,11,12 nerve palsy. (Due to skull base infection)

TUTORIALS LOGIN FOR SUCCESS

Examination by otoscopy

- GRANULATIONS in EAC, this leads to blood-stained ear discharge.
- Enumerate Levenson's criteria for malignant otitis externa

  1.Refractory otitis externa

  2.Severe nocturnal otalgia

  3.Purulent otorrhoea

  4.Granulation tissue in external canal

5. Growth of pseudomonas aeruginosa in specimen cultured from external canal
6. Presence of diabetes mellitus / other immunocompromised states

Investigation

- Technetium (technetium) bone scan. - for diagnosis
- HRCT temporal bone. (For extent of disease)

Treatment-

- DOC- 3rd gen cephalosporin +/- ciprofloxacin and oral ciprofloxacin at discharge from the hospital.

How to assess the response to treatment

- Gallium bone scan.
- ESR
- C- reactive protein.
- Cranial nerve examination.
- If response is unsatisfactory, the do surgical debridment.

Otomycosis 00:50:30

- Also called as Singapore ear.
- It is the fungal infection of EAC.
- The most common fungus to cause this is aspergillus niger,

- Second most common is candida.
- It is more commonly seen in the rainy season.
- c/c- itching in the ear.
- Examination - WET NEWSPAPER appearance.

Treatment-

- Aural toilet- by suction or dry mopping with a cotton tip probe.
- Antifungal ear drops. Eg- Clotrimazole, Nystatin

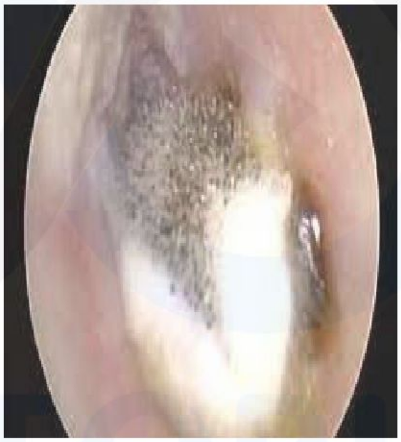
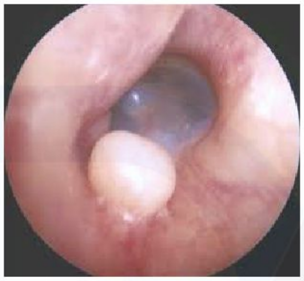
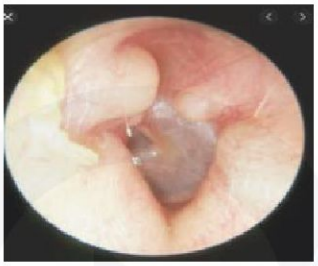


Fig: 11

EXOSTOSIS 00:52:36

- It is also called SURFER'S EAR.
- It is hyperplasia of bony EAC.
- It is more common in water sports persons so; it is called SURFER'S EAR. (See below)

Osteoma of EAC	Exostosis of EAC
It is single mass,	This is multiple,
Unilateral.	Bilateral
Pedunculated	Sessile
Treatment- surgery- canalplasty.	Treatment- surgery- canalplasty
	 Fig: 12

TYMPANIC MEMBRANE (TM)

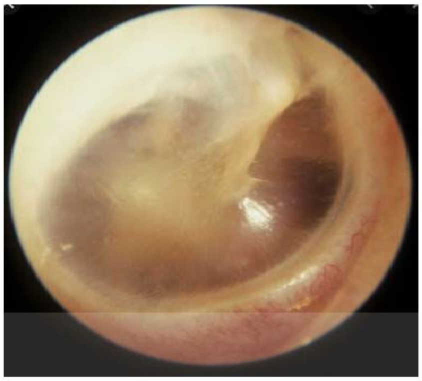


Fig: 1

- It is also called MYRING.
- It is PEARL GREY IN COLOUR, oval in shaped.
- Diameter of tympanic membrane is 9 - 10mm.
- Surface area is 90sqmm.
- Effective area is 45 sqmm, this is because the peripheral part of the tympanic membrane is more mobile than the central part.
- TM is lying at an angle of '55° with the horizontal.
- Posterosuperior part is more lateral than anteroinferior part.
- ANNULUS is a peripheral thickened tympanic membrane which fits into bony tympanic sulcus of temporal bone.
- NOTCH OF RIVINUS is a deficiency in the upper part of tympanic sulcus.
- TM shows movement on Seigelization. Seigelization means putting air pressure on a tympanic membrane. It is done with the help of Siegel speculum.

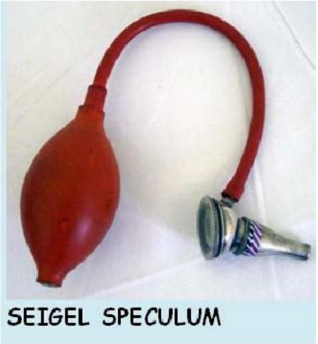


Fig: 2

TM has 4 landmarks 00:10:18

- Handle of Malleus.
- Lateral process of Malleus.
- UMBO - it is a tip of the handle of Malleus.
- Cone of light.
  - Cone of Light is formed by reflection of light from handle of the Malleus. (Light of otoscope)
- Cone of light position
  - Right ear it is 5 'o' clock
  - Left ear it is 7 'o' clock.

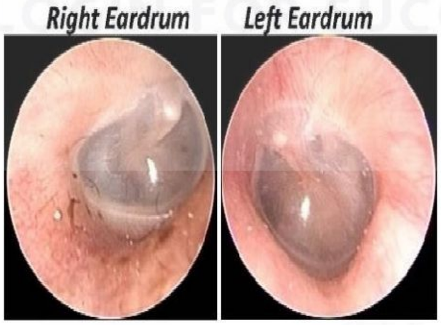


Fig: 3

Tympanic membrane has 2 parts-

- PARS TENSA (PT) see image below
  - It is major, lower and stronger part of TM

  - It has three layers.
  - outer- skin.
  - inner - mucosa.
  - middle - fibrous layer.
  - Pars Tensa makes the majority of tympanic membrane
- PARS FLACCIDA (PF) see image
  - It is also called SHRAPNELL'S MEMBRANE. Middle fibrous layer is almost absent in pars flaccida. It forms the small upper part of the tympanic membrane
  - Malleolar folds divide pars flaccida from pars tensa. There are 2 malleolar folds- anterior and posterior.

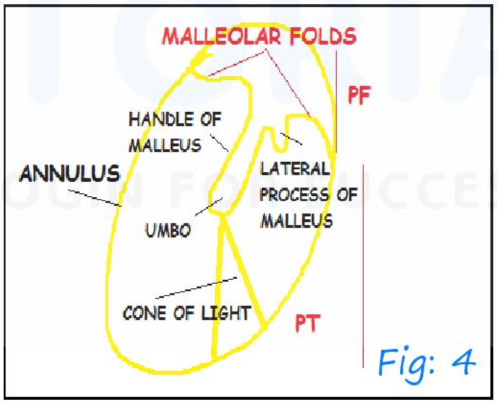
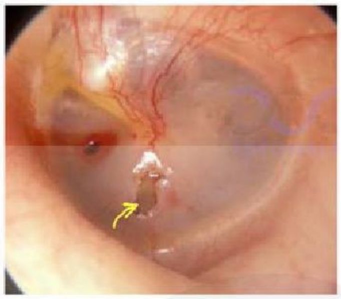

MALLEOLAR FOLDS
PF
HANDLE OF MALLEUS
ANNULUS
LATERAL PROCESS OF MALLEUS
UMBO
CONE OF LIGHT
PT

Fig: 4

Traumatic perforation of tympanic membrane 00:24:26



Traumatic perforation Fig: 5

- Treatment – conservative treatment. This will heal automatically. Keep ear dry.
- The healed part lacks fibrous layer. It is known as dimeric membrane.

AiraTaifeen.com

Myringitis bullosa 00:28:33

- This is Viral infection of tympanic membrane,
- There is multiple clear fluid filled vesicles.
- It is a painful disease and self-limiting disease

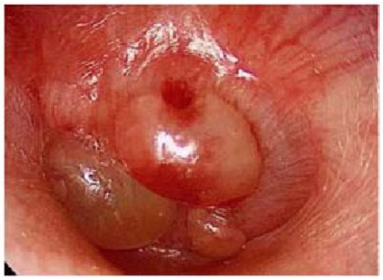


Fig: 6

Myringosclerosis 00:30:06

- It is a hyaline degeneration of the middle fibrous layer of tympanic membrane.
- It can be a sequel of pre-existing infection.

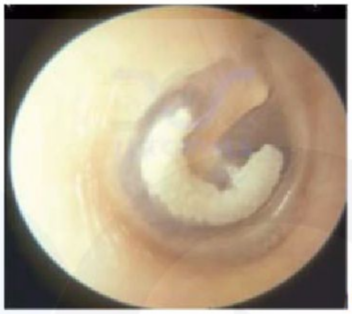


Fig: 7

EUSTACHIAN TUBE (ET)

- It connects the middle ear to the nasopharynx.
- Its nasopharyngeal opening lies 1.25cm behind the posterior end of inferior turbinate. It is 36mm in length, outer 12mm is bony (towards middle ear), inner 24mm is cartilaginous (towards nasopharynx).
- At birth, it is nearly horizontal, but in adults it has 45° angle with the horizontal.
- Tensor veli palatini or tensor palati muscle opens the tube during swallowing.
- Main function of the Eustachian tube is middle ear ventilation.

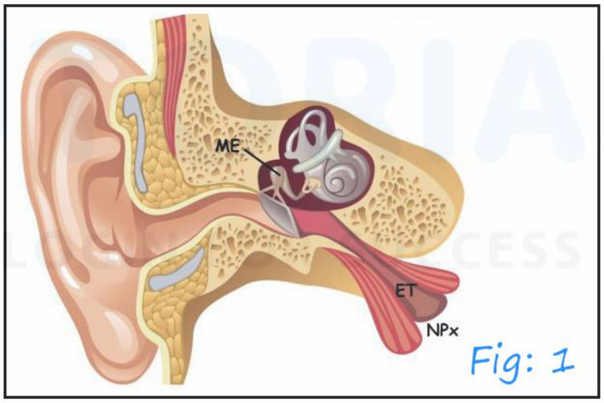


Fig: 1

ET function tests 00:07:20

- Valsalva – it is forceful expiration with closed nose and closed mouth.

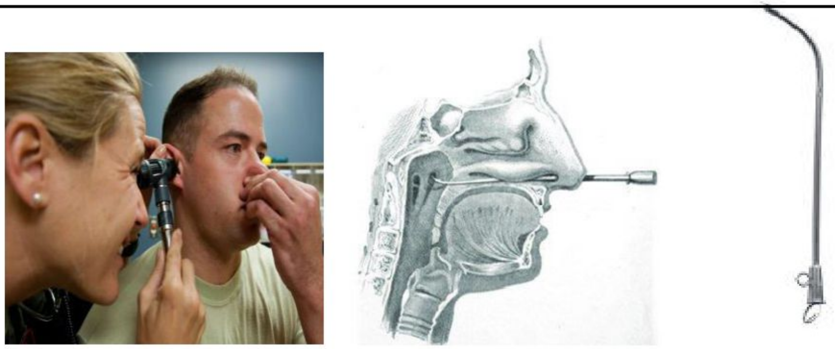
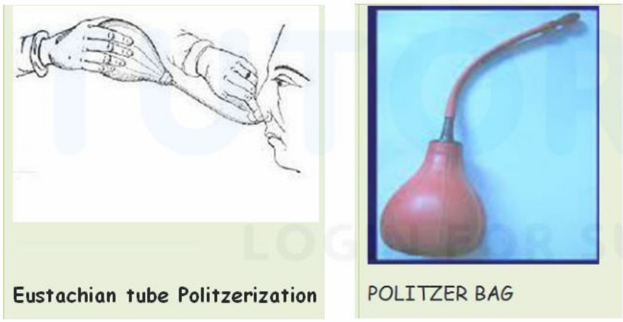


Fig: 2

Valsalva **Et Catheterization** **Catheter**

- Eustachian tube Politzerisation
  - It is done with the help of Politzer bag. Politzer bag has an olive shaped tip which is kept in the nostril and bag is in the doctor's hand and we see whether TM moves on deflation of bag.
  - Eustachian tube catheterization



Eustachian tube Politzerization

POLITZER BAG

Fig: 3

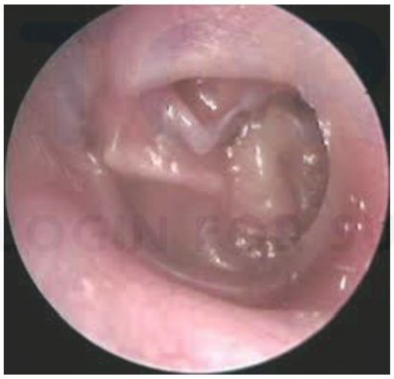
- Tympanometry- this is the best test assessment of Eustachian tube function. (MCQ)

Retracted tympanic membrane 00:13:30

- Main function of the Eustachian tube is middle ear ventilation.
- If ET gets blocked it will lead to negative pressure in the middle ear, this led to retracted TM.

Features of retracted tympanic membrane

- It is dull.
- Handle of the Malleus is medialised.
- Cone of light is distorted.
- Lateral process of Malleus is more prominent.
- On Seigelisation (air pressure), it shows less or no movement.



RETRACTED TM Fig: 4

Retraction pockets 00:19:30

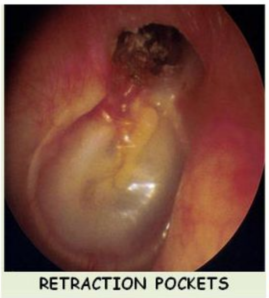

RETRACTION POCKETS

Fig: 5

- If there is too much retraction it will lead to formation of retraction pockets
- The retraction pocket is most commonly seen in pars flaccida and second common site is posterosuperior part of pars tensa.
- Retraction pocket is lined by skin and filled by keratin.

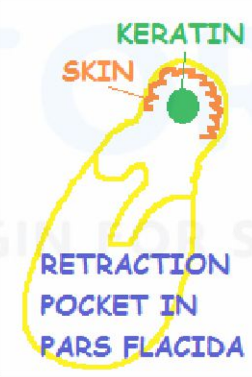

KERATIN
SKIN
RETRACTION
POCKET IN
PARS FLACIDA

Fig: 6

- If the retraction pocket is allowed to progress there will be small perforation at the tip of the Fundus of retraction pocket.
- Through this perforation, skin starts growing into the middle ear.

- Presence of skin in the middle ear is called cholesteatoma.
- (It is pearly white in colour). We will discuss cholesteatoma further in CSOM.

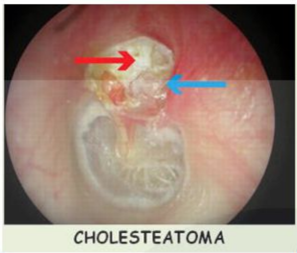

CHOLESTEATOMA

Fig: 7

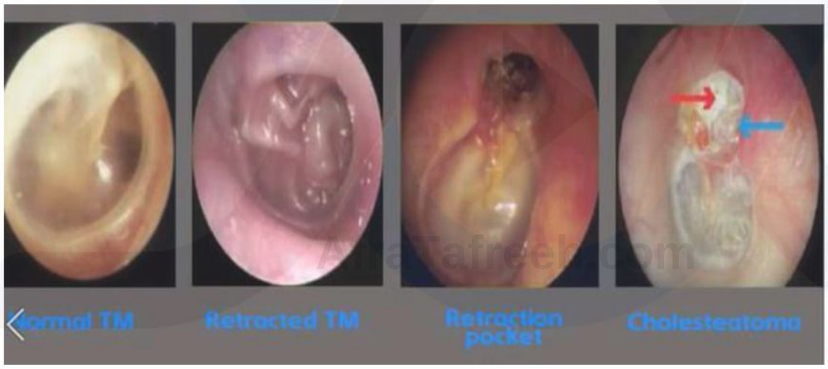

Normal TM
Retracted TM
Retraction pocket
Cholesteatoma

Fig: 8

Glue ear 00:29:37

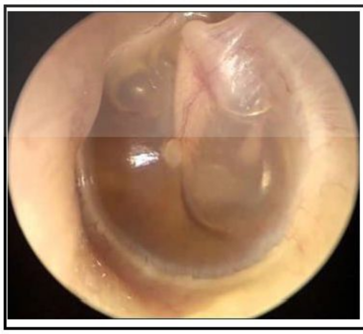


Fig: 9

- Glue ear is also called SEROUS OTITIS MEDIA or SECRETORY OTITIS MEDIA. (SOM)

- Its new name is OME (OTITIS MEDIA WITH EFFUSION).
- It is collection of sterile thick glue-like fluid in middle ear.
- Basic aetiology of glue ear is ET blockage
- Most common age is school age children

Causes of ET blockage

- Most common cause is adenoid hypertrophy causing ET blockage (mostly bilateral) seen in school age children.
- Rare cause- NASOPHARYNGEAL CARCINOMA causing ET blockage (mostly unilateral), seen in adults.

Clinical Picture

- School age child complaining of
- Heaviness in the ear (it is not painful disease).
- Conductive hearing loss (CHL). (10 to 40dB)
- Poor school performance.
- +/- Adenoid face (see image)

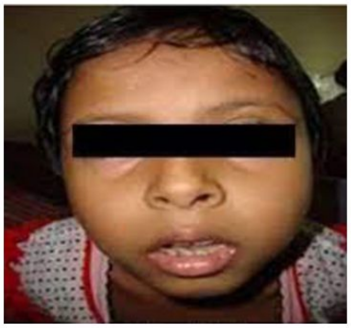


Fig: 10

Investigation

- PTA- pure tone audiometry (10-40dB in CHL)
- Tympanometry - type B (flat curve)

Examination

- Glue like fluid behind TM.
- Air bubbles trapped within glue.
- Retracted tympanic membrane.
- Very rarely bluish tympanic membrane.

Treatment

- Medical management- DECONGESTANT THERAPY. If no relief, then surgery.
- Surgery – Myringotomy in (Anteroinferior quadrant) + Grommet insertion (also called as middle ear ventilation tube) +/- adenoidectomy

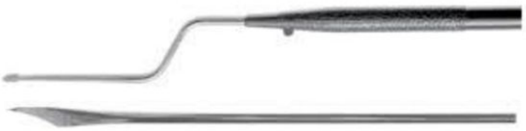


Fig: 11

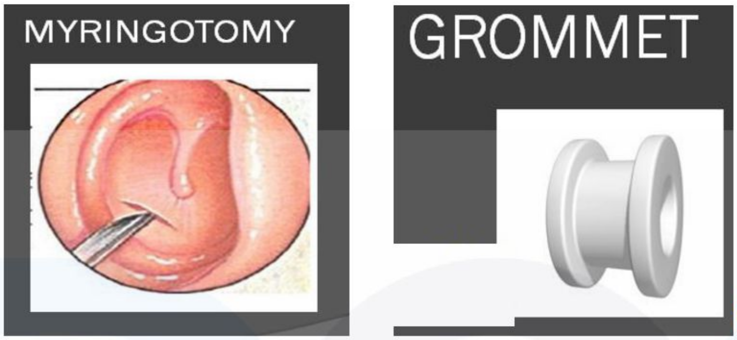

MYRINGOTOMY
GROMMET

Fig: 12

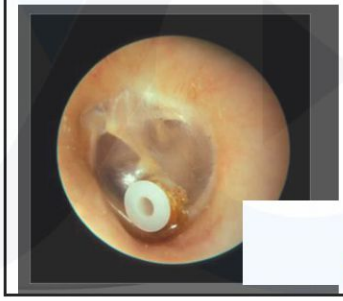


Fig: 13

MIDDLE EAR

- It is also called TYMPANUM.
- Middle ear is a hollow cavity in the temporal bone.
- It has three parts—

Mesotympanum (M)	It is covered by TM. It is the middle part of middle ear
Epitympanum (E)	Also called as ATTIC, it is covered by bone called SCUTUM.
Hypotympanum (H)	It is covered by bone (unnamed bone).

- Depth of middle ear
  - E – 6mm
  - M – 2mm
  - H – 4mm

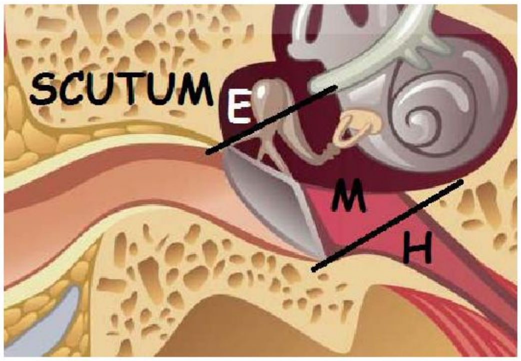


Fig: 1

Sensory supply of the middle ear 00:6:00

- It is by tympanic branch of Glossophraryngeal nerve
- (JACOBSON'S NERVE).

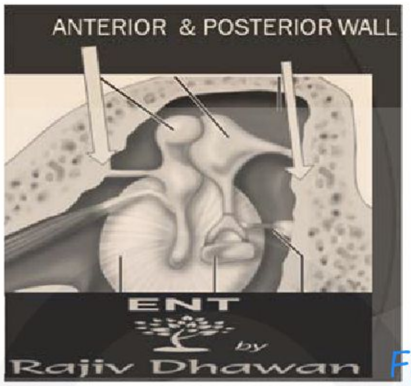
Referred otalgia 00:7:00

Tonsillectomy, tonsillitis, stylalgia, cancer of base of tongue	lead to earache via IX nerve.
Supraglottic cancer, pyriform sinus cancer	lead to earache via Xth nerve.
Dental caries, TMJ disorders	lead to earache via Vth nerve.

- Styalgia – long styloid process touching 9th nerve → throat pain referred to ear

Six walls of middle ear 00:14:18

Roof/ tegmen tympani	Above it lies the dura matter of temporal lobe of the brain.
Floor	Below the floor lies jugular bulb.
Anterior wall	Anterior to anterior wall lies internal carotid artery. This wall has 2 openings, Lower opening- for eustachian tube

	Upper opening for tensor tympani muscle which is attached to malleus. This muscle is supplied by mandibular division of trigeminal nerve.  Fig: 2
Posterior wall	It has a projection called PYRAMID. From pyramid, Stapedius muscle tendon comes and attached to stapes, this muscle is supplied by the facial nerve.
Lateral wall	It is made by Tympanic membrane and SCUTUM.
Medial wall	Behind this wall lies the inner ear This wall has 8 important landmarks described below A. Medial wall has Two projections of inner ear

	Promontory- projection of basal turn of cochlea. Lateral semicircular canal projection called lateral SCC bulge. B. Medial wall has 2 windows for inner ear Oval window- which is covered by a footplate of stapes. Round window- it is covered by round window membrane. Also called as secondary TM. C. Medial wall has 2 bony spicules Ponticulus- it is from promontory to pyramid. Subiculum- it separates the oval window & round window. Sinus tympani- is the space between Ponticulus and Subiculum. It is a hidden area; therefore, it is the most common site of residual cholesteatoma after mastoid surgery. D. Medial wall has 2 miscellaneous structures Processus cochleariformis – it is surgical landmark for 1st genu of facial nerve. Horizontal segment of facial nerve.

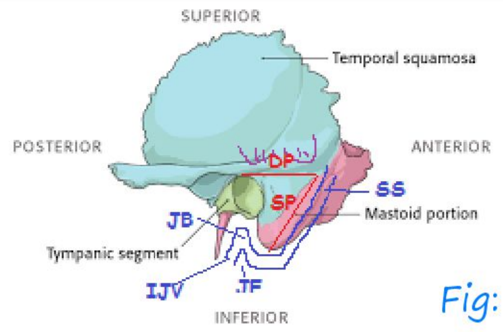

SUPERIOR
Temporal squamosa
POSTERIOR
ANTERIOR
DP
SS
SP
Mastoid portion
JB
Tympanic segment
IJV
JF
INFERIOR

Fig: 3

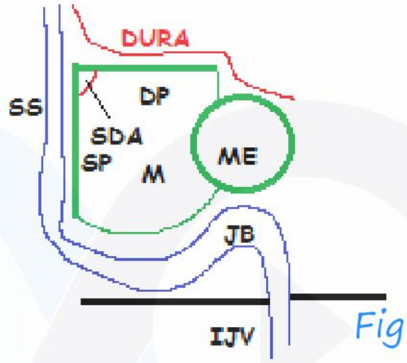

DURA
SS
DP
SDA
SP
M
ME
JB
IJV

Fig: 4

SDA (SINODURAL ANGLE)/ CITELLI'S ANGLE.

Above the ear	Brain
Below the ear	jugular bulb
Behind the ear	sigmoid sinus

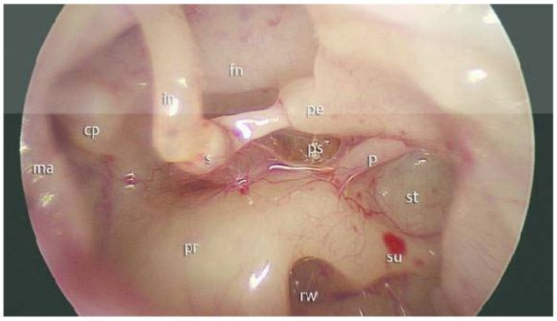

fn
in
pe
cp
ps
s
p
ma
st
pr
su
rw

Fig: 5

- This is best described in class /App video with images and description

MIDDLE EAR CLEFT - ASOM - SAFE CSOM

- Middle ear cleft is a combination of all hollow cavities in temporal bone.

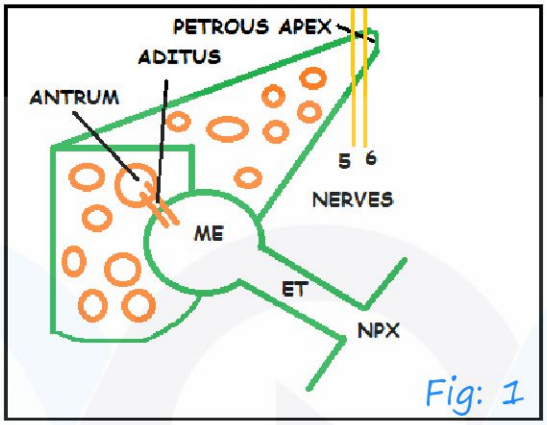

PETROUS APEX
ADITUS
ANTRUM
5
6
NERVES
ME
ET
NPX

Fig: 1

- Antrum- it is the largest and most constant mastoid air cell. Antrum is connected to the middle ear through aditus.
- It has 5 parts
  - Eustachian tube.
  - Middle ear.
  - Aditus.
  - Antrum.
  - Rest of air cells.
- All these hollow spaces are mucosa lined and are interconnected

Spread of Disease

NPx to middle ear	OTITIS MEDIA
ME to mastoid	Mastoiditis
ME to petrous apex	Petrositis

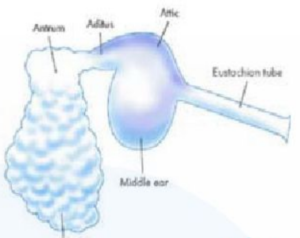

Antrum
Aditus
Attic
Eustachian tube
Middle ear
Mastoid air cells

Fig: 2

Fig: 3

Diseases of middle ear cleft 00:09:38

ASOM- acute suppurative otitis media 00:09:43

- It is an infection of the middle ear mucosa by pyogenic organisms.
- Most common organism to cause this is streptococcus pneumoniae.
- Infection reaches nasopharynx to the middle ear via the eustachian tube.

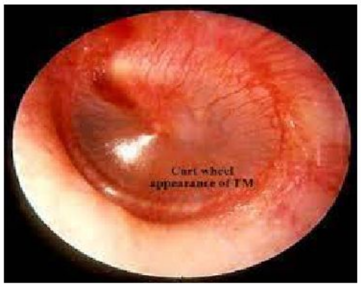

Cart wheel appearance of TM

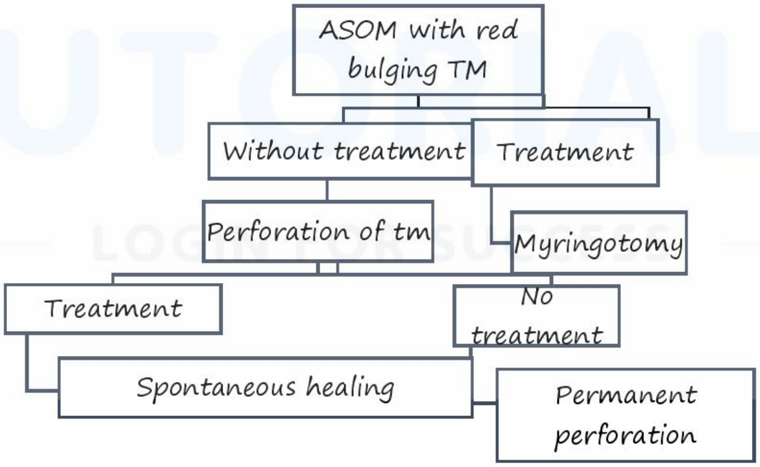
Fig: 4

- C/C- earache.

- Examination- red tympanic membrane with dilated capillaries
- (CART WHEEL SIGN)
- Treatment-
  - medical management.
  - Antibiotics like Co-Amoxiclav.
  - Decongestant (first nasal decongestant and then systemic decongestant).
  - Analgesics.

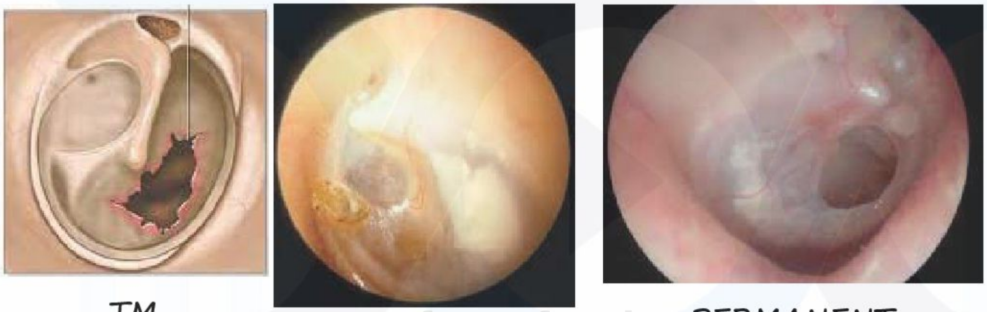
MCQ-

- Q. ASOM patient with severe earache and red bulging tympanic membrane.
  - Answer-Treatment is Myringotomy (in Posteroinferior quadrant)


ASOM with red bulging TM
Without treatment
Treatment
Perforation of tm
Myringotomy
Treatment
No treatment
Spontaneous healing
Permanent perforation

- If no management is done in a patient of ASOM with red bulging TM, it will lead to perforation of tympanic membrane

- If TM perforates and treatment is taken- this perforation will have spontaneous healing within the next few weeks in most of the cases. Healed membrane is thin and weak and lacks fibrous layer, so called DIMERIC MEMBRANE.
- If no treatment is taken for next 3months- it will lead to permanent perforation. This disease is called safe CSOM.



TM PERFORATION

HEALED TM

PERMANENT PERFORATION (Safe CSOM)

Fig: 5

Safe CSOM 00:18:51

- It is also called TUBOTYMPANIC CSOM.
- It is characterized by the presence of permanent central perforation in Pars Tensa of TM.
- Any perforation of pars flaccida will be part of unsafe CSOM

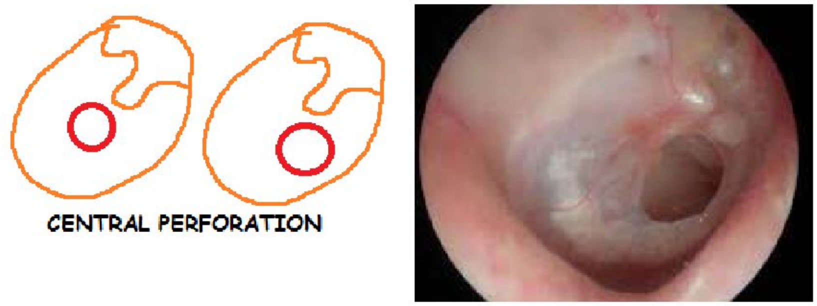


Fig: 6

- Permanent perforation means margins of perforation are epithelialized and there is no possibility of spontaneous healing.
- Central perforation means intact tm margin all around the perforation.

Chief complaint

- Ear discharge– Discharge is mucopurulent, not foul smelling and not blood stained. Amount of discharge increases when patient get upper respiratory infection.

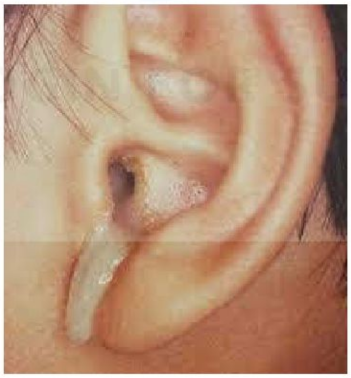


Fig: 7

- Hearing loss (Conductive)

Ossicle Erosion

- In long standing cases there can be ossicular erosion.
- First ossicle to be eroded is Incus.
- WHY INCUS? – Incus has no muscle attached to it, so it has least blood supply. The first part of incus to be eroded is lenticular process followed by long process.

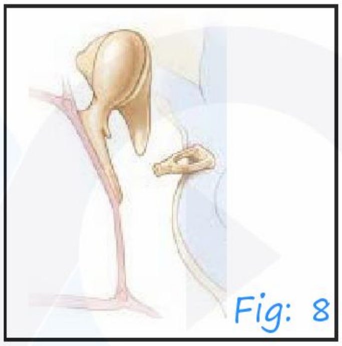


Fig: 8

Austin classification of ossicular erosion

- It has 4 types

TYPE	OSSICLE STATUS
A	I (–) M (+) S (+)
B	I– M (+) S (–)
C	I– M (–) S (+)
D	I– M (–) S (–)

- S means superstructure. Footplate is commonly preserved

Ossicular chain defect

- Austin's classification
- 4 common types: incus absent in all cases and TM reconstruction required in all cases

  1.Type: A M+, S+
    - Loss of part of incus or total loss of incus

  2.Type B: M+, S-
    - Loss of incus & stapes superstructure but the malleus handles still present

  3.Type C: M+. S+
    - Loss of incus & malleus but the stapes superstructures still present

  4.Type D: M- S-
    - Loss of incus, malleus & superstructures of stapes, but mobile footplate still present
- Investigation- PURE TONE AUDIOMETRY (PTA), this will show CHL. (conductive hearing loss). Ossicle erosion will increase CHL.
- Treatment is surgery. Ear should be dry for at least 6 weeks before surgery.

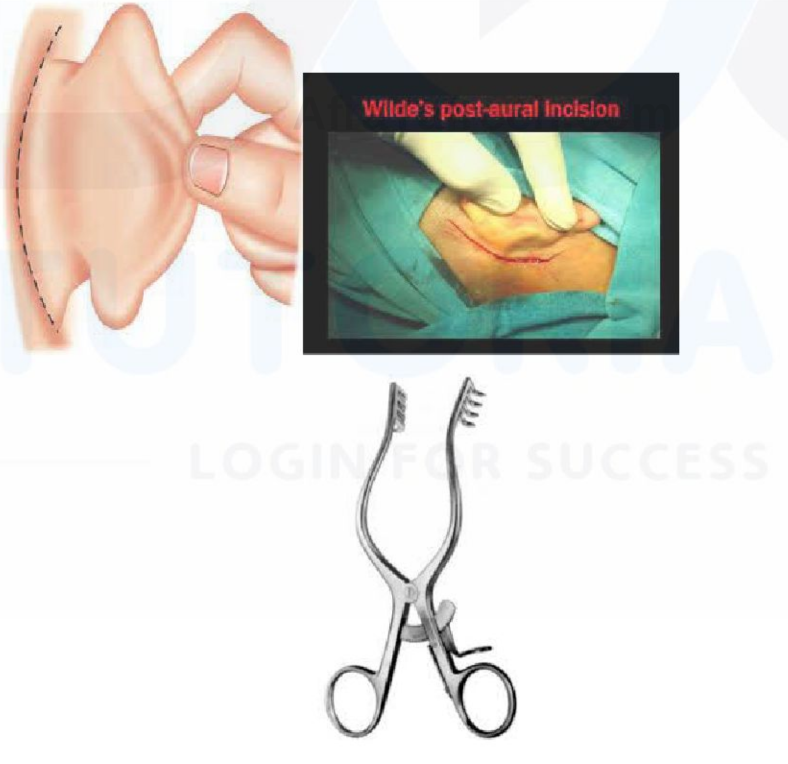
Surgical options:

Myringoplasty

- It is the repair of tympanic membrane perforation using a graft.
- Most commonly used graft is Temporalis fascia as:

- It can be taken from the same incision used for ear surgery.
- No morbidity at donor site.
- Same BMR as tympanic membrane.

- Other graft- tragal perichondrial graft.
- Most commonly used approach is the postural approach, it is done by WILDE'S post aural incision. This incision is given 6mm lateral to retro auricular groove. We use MOLLISON'S self-retaining mastoid retractor to expose the area. It's a microscopic ear surgery.



MOLLISON RETRACTOR Fig: 9

- Other approach- PERMEATAL APPROACH.

- Most commonly used technique for putting the graft is UNDERLAY TECHNIQUE. In this technique we put the graft below the margins of TM after elevating the TYMPANOMEATAL FLAP.
- Another technique of putting graft is OVERLAY TECHNIQUE. In which graft is placed between the skin and other layers of TM.

Tympanoplasty 00:38:46

- It is inspection and repair of middle ear ossicular assembly in addition to myringoplasty.
- It has 5 types-
- Wullstein classification of tympanoplasty -5 TYPES

TYPE I	All ossicles found normal M (+) I (+) S (+)
TYPE II	M (-) I (+) S (+). TM graft is placed in contact with incus.
TYPE III	M (-) I (-) S (+). TM graft is placed in contact with stapes. This surgery is also called MYRINGOSTAPEDIOPEXY or COLUMELLA TYMPANOPLASTY.
TYPE 4	M (-) I (-) S head (-) (Only footplate of stapes left)

	TM graft is placed in such a way that covers the round window while leaving the oval window exposed to the outside world. This is done to maintain the phase difference between oval window and round window. This is also called the ROUND WINDOW SHIELDING EFFECT.
TYPE 5	Fenestration operation, it is an obsolete procedure. It was done previously for otosclerosis

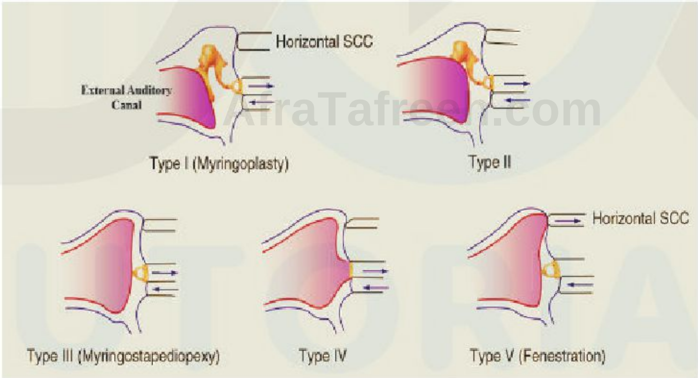
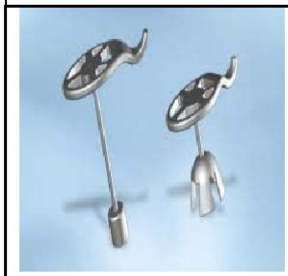
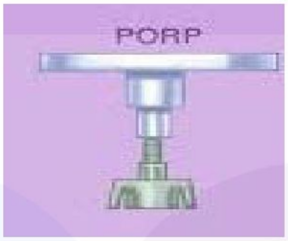
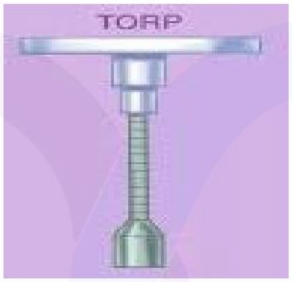

Horizontal SCC
External Auditory Canal
AiraTafreen.com
Type I (Myringoplasty)
Type II
Horizontal SCC
Type III (Myringostapediopexy)
Type IV
Type V (Fenestration)

Fig: 10

Ossicular replacement prosthesis (ORP) 00:49:55

- They are made of titanium or Teflon or Hydroxyapatite.
- ORP are 2 types

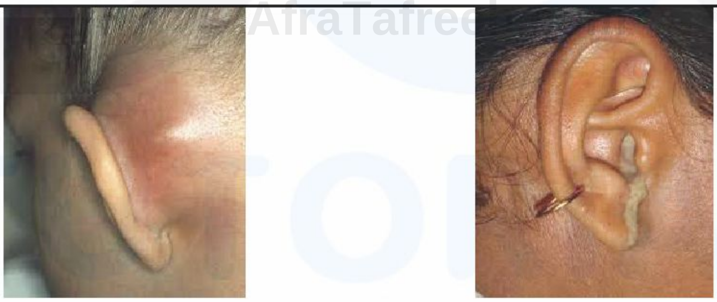
	PORP (partial ORP)	TORP (total ORP)
 Fig: 11	M (-) I (-) S (+). PORP has a cup-like end to hold the head of stapes.  	M (-) I (-) S head (-). TOPR has a flat base to stand on the footplate of stapes. 

MASTOIDITIS

Mastoiditis 00:00:17

Acute mastoiditis

- It is an infection of the mastoid including air cells. It is a complication of ASOM and CSOM.
- Chief complaint-
  - pain behind the pinna,
  - profuse ear discharge
- On examination – Mastoid surface is found to be smooth, red and shiny. This is called the Ironing of the mastoid surface. It is the first sign of Mastoiditis.



ironing of mastoid surface **profuse ear discharge** Fig: 1

What is reservoir sign & light house sign?

- This patient complains of profuse ear discharge. On cleaning the discharge fills immediately again this is called RESERVIOR SIGN.
- The pus is continuously flowing from mastoid to middle ear. This is called PULSATILE OTORRHEA and also called LIGHT HOUSE SIGN. (Can also be seen in suppurative stage of ASOM)

Mastoid tenderness is positive-

- Tenderness is checked at
  - Over the antrum. (In cymba conchae area).
  - Over posterior border.
  - Over the tip of the mastoid.

Another Examination finding

- In EAC there is sagging of skin in the posterosuperior area

Investigation-

- X ray mastoid right and left lateral oblique view. It is called Schuller's view. This is the most used x-ray view for mastoids in ENT. This X-ray shows two findings
  - Clouding of air cells.
  - Coalescence of air cells.

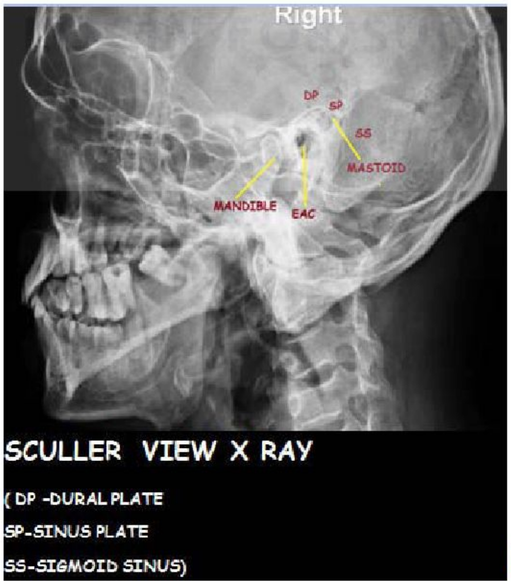

Right
DP
SP
SS
MASTOID
MANDIBLE
EAC
SCULLER VIEW X RAY
(DP -DURAL PLATE
SP-SINUS PLATE
SS-SIGMOID SINUS)

Fig: 2

Treatment-

- Intravenous antibiotics for 48 hrs, if no recovery then do surgery.
- Surgery is CORTICAL MASTOIDECTOMY. It is also called as SCHWARTZ OPERATION.
- First cell to be located during mastoid surgery is MASTOID ANTRUM since it is the most constant and largest cell of mastoid.
- How to find Mastoid antrum?
  - Landmark for mastoid antrum is McEwen's Triangle also called as Suprameatal triangle.

Cortical Mastoidectomy

- This is Canal wall up surgery (CWU).
- Canal wall means posterior wall of EAC, UP means it is INTACT.

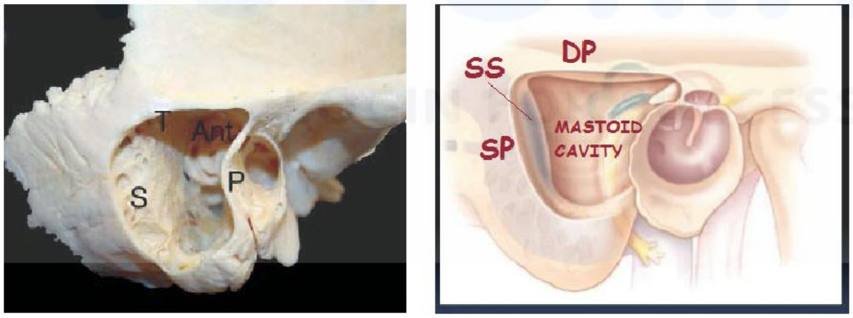


Fig: 3

Korner septum-

- It's an embryological error (anatomical variation).
- It is due to persistence of PETROSQUAMOUS SUTURE.
- It leads to difficulty in finding antrum for surgery.

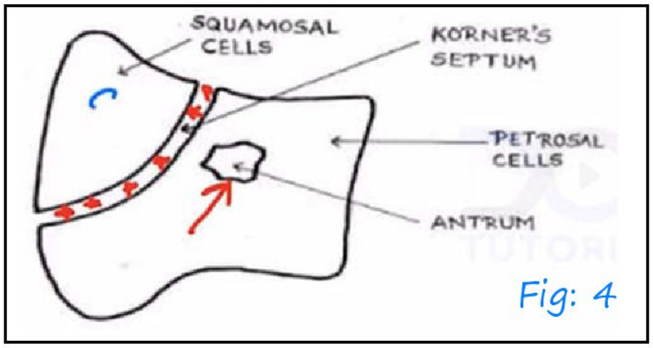

SQUAMOSAL CELLS
KORNER'S SEPTUM
C
PETROSAL CELLS
ANTRUM

Fig: 4

Abscess formation-

- CAUSE - untreated Mastoiditis can lead to abscess formation at 4 sites
- These Sites are
  - Most common site is mastoid abscess, which is post auricular abscess.
  - Inside EAC, that is called LUC'S abscess.
  - Along Sternocleidomastoid is BEZOLD'S abscess.
  - Along Digastric muscle is called CITELLI'S abscess

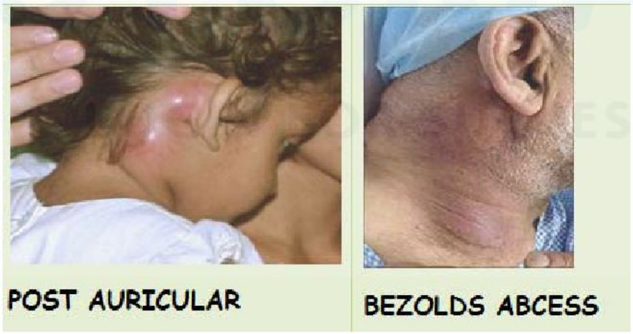

POST AURICULAR
BEZOLDS ABCESS

Fig: 5

Petrositis- gradinego syndrome 00:26:45

- It is an infection of Petrous apex air cells.
- It's a complication of ASOM or CSOM.
- Petrous apex has relation with 5th and 6th cranial nerves

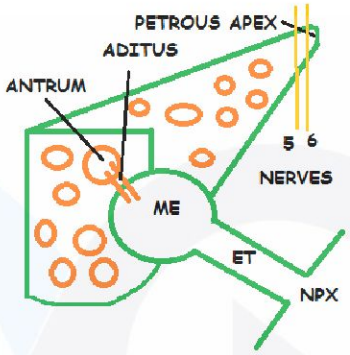

PETROUS APEX
ADITUS
ANTRUM
5
6
NERVES
ME
ET
NPX

Fig: 6

- It has 3 features- MCQ MNEMONIC GERD
  - Gradinego syndrome (G)
  - Ear discharge. (E)
  - Retro orbital pain due to 5th nerve involvement. (R)
  - Diplopia due to 6th nerve involvement. (D)
- CT scan of temporal bone will show abscess at Petrous apex.

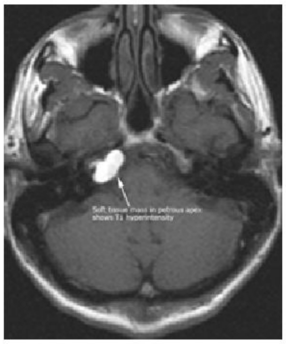

Soft tissue mass in petrous apex shows T1 hyperintensity

Fig: 7

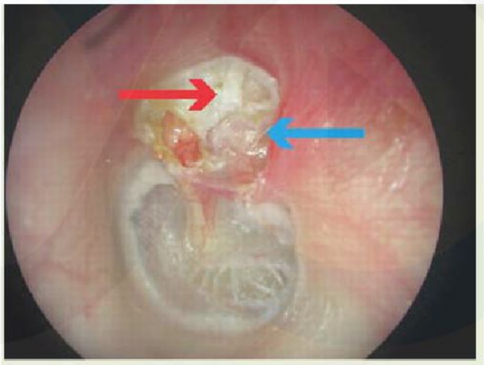
Treatment- surgical exploration.

UNSAFE CSOM- ATTICOANTRAL CSOM

- Hallmark of this disease is the presence of cholesteatoma

What is cholesteatoma?

- Cholesteatoma is the ectopic presence of skin in the middle ear cleft. It is pearly white in colour



Cholesteatoma Fig: 1

Most common site of cholesteatoma

- PRUSSAK'S SPACE in Epitympanum; (SEE IMAGE BELOW –PS)
- It is the space between the pars flaccida (SHARPNELL'S MEMBRANE) and the neck of Malleus.

Prussak's Space:

- Potential space which may be first to involve during extension of cholesteatoma,
- Bounded by,
  - Laterally, Sharpnell's membrane medially, neck of malleus
  - Superiorly, fibres of lateral malleolar fold
  - Inferiorly, lateral process of malleus

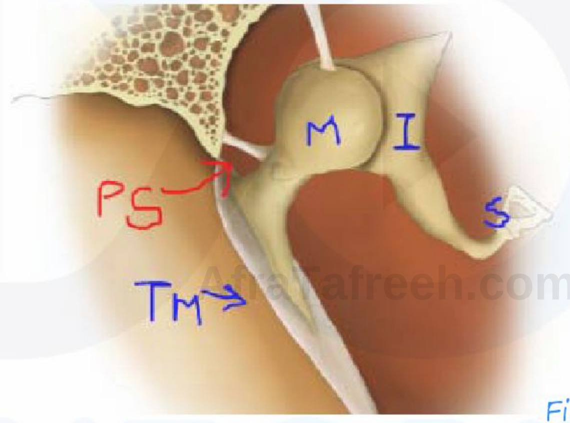


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Fig: 2

Origin of cholesteatoma (Four Types)

- Most commonly Cholesteatoma originates from RETRACTION POCKETS
  - Retraction Pockets are most common in Pars Flaccida.
  - This is called primary acquired cholesteatoma
  - This theory is called WITTMACKS THEORY.

DOC TUTORIALS LOGIN FOR SUCCESS

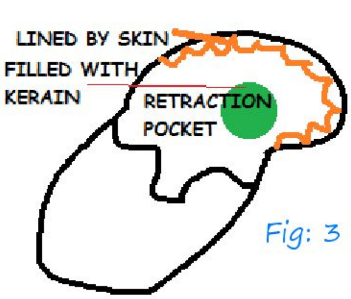

LINED BY SKIN
FILLED WITH
KERAIN
RETRACTION
POCKET

Fig: 3

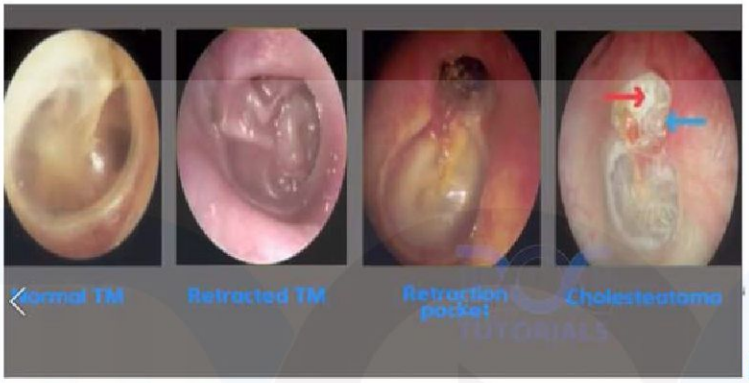

Normal TM
Retracted TM
Retraction pocket
Cholesteatoma

Fig: 4

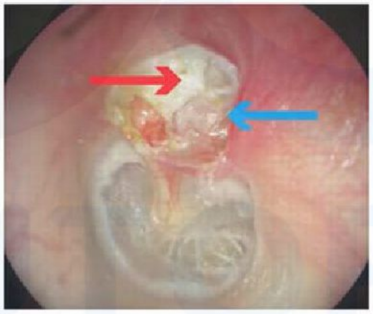
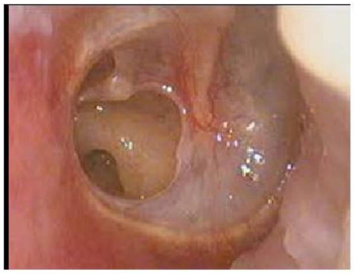


Fig: 5

- If the retraction pocket is allowed to progress there will be small perforation at the tip of the Fundus of retraction pocket. Through this perforation, skin starts growing into the middle ear. Presence of skin in the middle ear is called cholesteatoma.

Origin From marginal perforation



Marginal perforation Fig: 6

- Marginal perforation means perforation with absence of one margin.
- EAC skin can enter the middle ear through absent margin of perforation.
- This is called SECONDARY ACQUIRED CHOLESTEATOMA.
- This origin is called HABERMANN'S THEORY.

Tertiary acquired cholesteatoma

- it is due to accidental implantation of skin in middle ear during surgery or trauma.

Congenital cholesteatoma

- We use LEVENSON'S CRITERIA to diagnose this condition.
- It presents as PEARLY WHITE MASS behind INTACT TYMPANIC MMBRANE

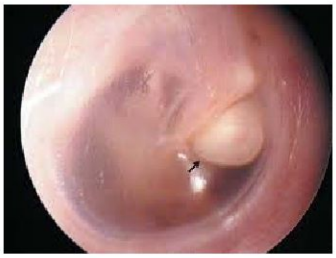


Fig: 7

Levenson criteria (Modified Derlacki & Clemis)

- White mass medial to normal TM
- Normal pars flaccida and tensa
- No history of otorrheal or perforations
- No prior ontological procedures
- Prior bouts of otitis media not grounds for exclusion

Why is cholesteatoma unsafe?

- Answer –It is due to bone erosion.
- Mechanism of bone erosion
  - Inflammatory osteitis.
  - Secretes bone destroying enzymes.
  - It leads to Complications, so it is called unsafe CSOM.

Chief complaints

- Ear discharge– scanty, foul smelling (due to bone erosion) and blood stained (due to granulation formation).
- Hearing loss is mostly conductive, sometimes mixed (CHL+ SNHL)

Treatment

- Surgery is called MRM (Modified Radical Mastoidectomy) also called as tympan mastoid exploration.
- Main aim of MRM is to make the ear safe. (MCQ)
- After making adequate clearance of cholesteatoma, we remove the posterior wall of EAC to open the mastoid cavity into EAC. Hence, MRM is a classic example of canal wall down surgery (CWD). Canal wall means posterior wall of EAC and down means removed.

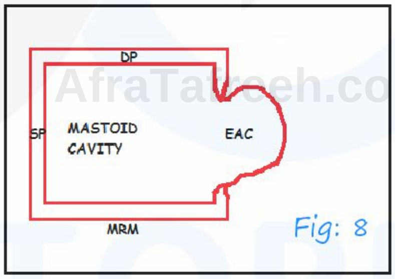
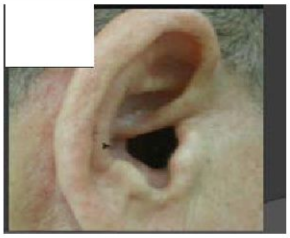


Fig: 8

- Most common site of residual cholesteatoma after mastoid surgery is sinus tympani.

Meatoplasty 00:23:18

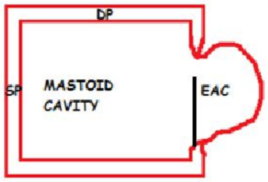
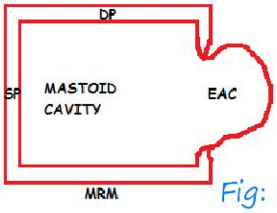


Meatoplasty Fig: 9

- This surgical step is aimed at widening the EAC. It is done by removing the part of Conchal cartilage.

Uses

- Adequate ventilation of mastoid cavities.
- Proper inspection & cleaning of mastoid cavities.
- Limited cholesteatoma – intact canal wall mastoidectomy (combined approach tympanoplasty)

CANAL WALL UP procedure	CANAL WALL DOWN procedure
Examples 1.Cortical Mastoidectomy (done for acute Mastoiditis) 2. Combined approach Tympanoplasty (CAT). This is also called Intact canal wall mastoidectomy. This surgery is done for limited cholesteatoma.	Examples 1Modified Radical Mastoidectomy (MRM) 2. Radical Mastoidectomy. 3. Atticotomy.
	 Fig: 10

Complications of unsafe CSOM 00:29:36

Extracranial

- Mastoiditis – most common
- Intracranial complication - meningitis
- Facial nerve palsy.
- Labyrinthitis.
- Labyrinthine fistula.
- Petrositis.
- Abscess formation.

Labyrinthine fistula 00:30:13

- This is the Erosion of bony cover of lateral semicircular canal bulge which lies on the medial wall of middle ear. It is due to bone eroding properties of cholesteatoma.

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Chief complaint- vertigo.

- Examination- Positive fistula sign. There are 2 ways of checking for this
- It is best seen with Seigelisation (putting air pressure on TM with Seigel speculum). This stimulates inner ear and patient experiences vertigo and nystagmus).

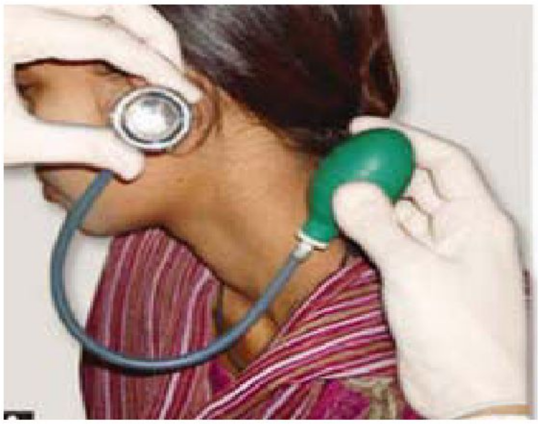


Fig: 11

- 2^{nd} Method to look for Fistula sign
- Put your hand on head and give pressure on the tragus, nystagmus is seen

False positive fistula sign	False negative fistula sign
Aka Hennebert sign • Congenital syphilis. • Superior SCC dehiscence • Meniere's disease.	• Fistula in a dead labyrinth. • Fistula covered by cholesteatoma. • Wrong technique.

- Treatment- surgery is MRM + cover the fistula with Temporalis fascia graft.

Intracranial complications of unsafe CSOM 00:38:50

Intracranial complications

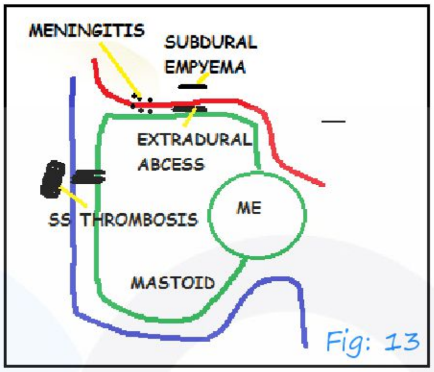

MENINGITIS
SUBDURAL EMPYEMA
EXTRADURAL ABCESS
SS THROMBOSIS
ME
MASTOID

Fig: 13

- Meningitis.
- Extradural abscess.
- Subdural empyema.
- Brain abscess.
- Sigmoid sinus thrombosis.
- Otic hydrocephalus.

Brain abscess 00:38:55

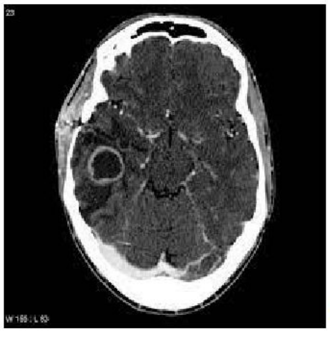


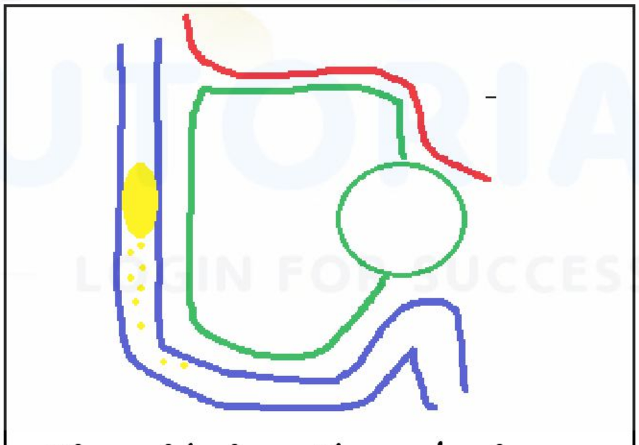
Fig: 14

- Most common site of otogenic brain abscess is the temporal lobe and the second site is cerebellum.
- C/C -chronic ear discharge → headache and convulsions.
- Investigation- CECT brain.
- Treatment is Neurosurgery.

Sigmoid sinus thrombosis/ lateral sinus thrombosis 00:42:40

- It is an intracranial complication of unsafe CSOM.

Clinical Picture



Sigmoid sinus thrombosis Fig: 15

- Headache.
- Pallor.
- Spiky fever. This fever is called PICKET FENCE FEVER.

- Pitting edema on a mastoid. This is called GRIESSINGER SIGN. This is due to blockage of Mastoid emissary veins which are also drained in the sigmoid sinus
- There is No change in CSF pressure on pressing IJV. it can be seen in two ways:
- On lumbar puncture- it is called TOBEY AYER TEST
- On Fundus (retina) examination- it is called CROWE BECK TEST

Investigation

- CECT brain - it will show empty delta signs.
- On a plain CT brain - it will show delta signs.

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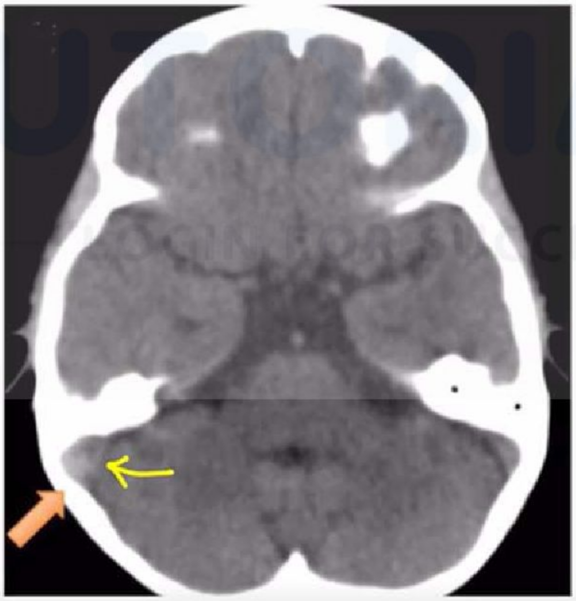


Fig: 16

- Treatment- MRM + open the sinus plate & clear the thrombus till fresh bleeding starts

One liner to memorise

- Most common complication of unsafe CSOM is Mastoiditis.
- Most common intracranial complication of unsafe CSOM is Meningitis.
- 25% of brain abscess in children are OTOGENIC.
- 50% of brain abscess in adults are OTOGENIC.
- Treatment of unsafe CSOM + extradural abscess – MRM +open the Dural plate & drain the abscess.
- If infection crosses Dura e.g., Subdural empyema, brain abscess – in those situations treatment of choice will be neurosurgery

INNER EAR (LABYRINTH)

Anatomy

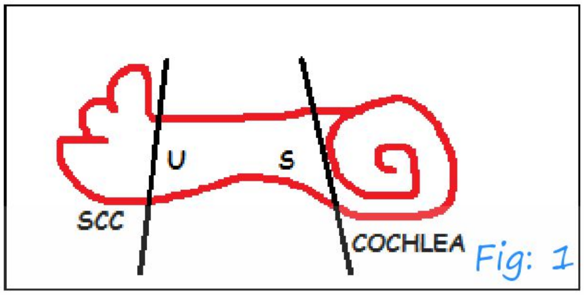

U
S
SCC
COCHLEA

Fig: 1

- It is also called labyrinth.
- It has two parts-
  - Membranous labyrinth- it is the true inner ear.
  - Bony labyrinth is the bony cover of inner ear

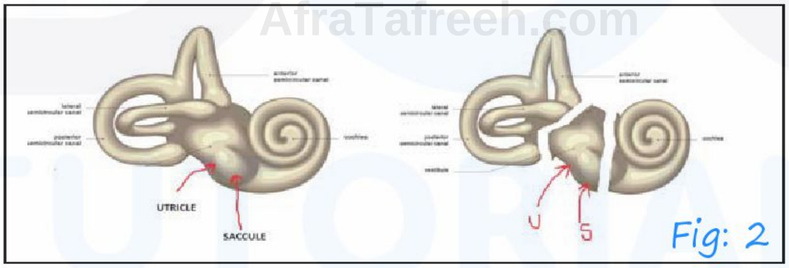

anterior semicircular canal
lateral semicircular canal
posterior semicircular canal
cochlea
UTRICLE
SACCULE
anterior semicircular canal
lateral semicircular canal
posterior semicircular canal
vestibule
cochlea
U
S

Fig: 2

Parts of inner ear	Function	Sensory end organ
Cochlea	Hearing	Organ of corti.
Utricle & saccule	Linear balance.	Macula.
Semicircular canals	Angular balance	Crista.

Fluids of inner ear 00:07:30

- Inner ear is filled with endolymph and surrounds it with perilymph.

Endolymph

- It is produced by stria vascularis of cochlea and it is absorbed by the endolymphatic sac.
- If the endolymphatic sac does not absorb it properly it leads to Meniere's disease.
- In Meniere's disease – there will be gradual cochlear damage due to high endolymph pressure. (Meniere's is glaucoma of ear)

Perilymph

- it is nothing but CSF.

Perilymph is found in	CSF is found in
Inner ear	Subarachnoid space

- CSF and perilymph are connected by aqueduct of cochlea.
- This is the pathway that can lead to post meningitis deafness.

Ions

Endolymph	High k+, low Na+.
Perilymph	High Na+, low k+.

- Endocochlear potential is +80mv.

Cochlea 00:16:45

- It has 2 ¾ turns.

cochlea

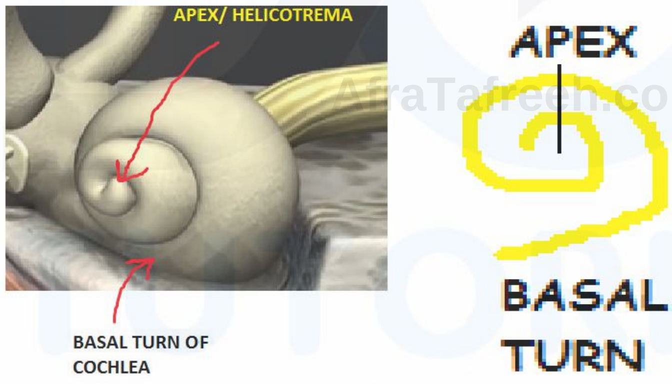

APEX/ HELICOTREMA
BASAL TURN OF COCHLEA
APEX
BASAL TURN

Fig: 3

Basal turn	Senses high freq sounds.
Apex turn/ helicotrema	Senses low freq sounds

Cut section of cochlea 00:19:08

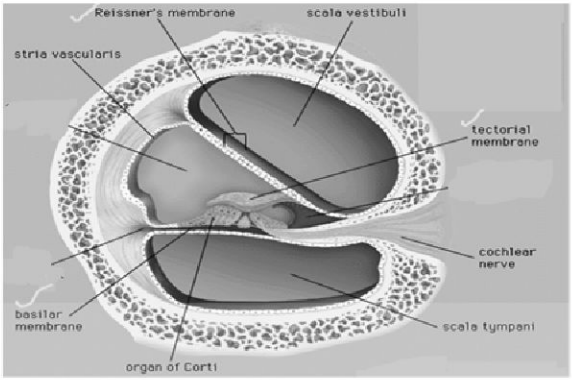

Reissner's membrane
scala vestibuli
stria vascularis
tectorial membrane
cochlear nerve
basilar membrane
scala tympani
organ of Corti

Fig: 4

- Cochlea is a rolled tube. It's a fleshy tube in a bony tube.
- Scala vestibuli and scala media are separated by Reissner's membrane.
- Organ of corti is lying on the basilar membrane and covered by the tectorial membrane.
- Sound energy- it moves a basilar membrane which stimulates the organ of corti. This theory is called travelling wave theory of Von Bekesy.
- **Cochlea is connected to saccule through a channel called ductus reunions.**

Utricle and saccule (vestibule) 00:27:55

- Utricle and saccule are also called vestibule or otolithic organs.

Utricle and saccule	Linear balance.
Utricle	Horizontal linear balance.
Saccule	Vertical linear balance.

- Macula is the sensory end organ of utricle and saccule. It is covered by a gelatinous layer. this layer has calcium carbonate crystals called otoconia or otoliths.

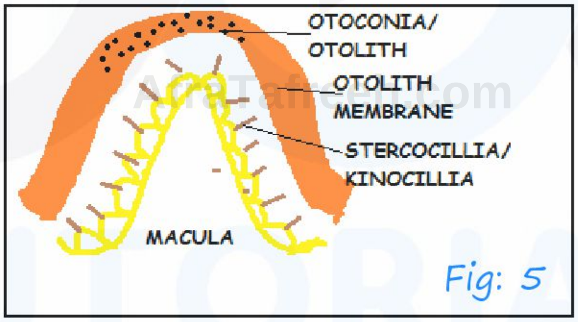

OTOCONIA/
OTOLITH
OTOLITH
MEMBRANE
STERCOCILLIA/
KINOCILLIA
MACULA

Fig: 5

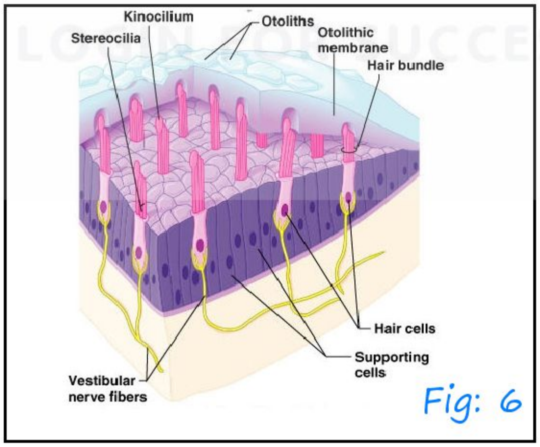
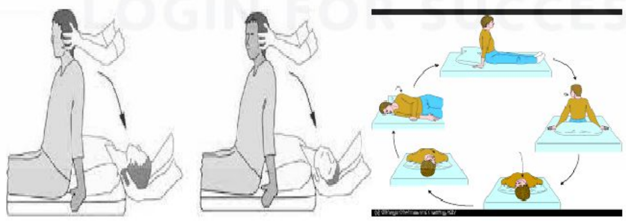

Kinocilium
Otoliths
Stereocilia
Otolithic membrane
Hair bundle
Hair cells
Supporting cells
Vestibular nerve fibers

Fig: 6

BPPV (benign paroxysmal positional vertigo)

00:33:18

- BPPV is the most common cause of peripheral vertigo. This disease is more common in females.
- Cause--otoconia gets displaced and reaches the semicircular canal (the most commonly involved canal is posterior semicircular canal).
- Chief complaint- vertigo for few seconds on changing head position. Vertigo is with nausea and vomiting. There is no hearing loss in this condition.
- Diagnostic test of BPPV- Dix Hallpike's manoeuvre. This test shows nystagmus (rotational and geotropic) on putting the patient on supine position from sitting position.
- Treatment of BPPV- Epleys maneuver (particle repositioning maneuver)- it is the treatment of choice.



Dix Hallpike maneuver. **Epleys maneuver**

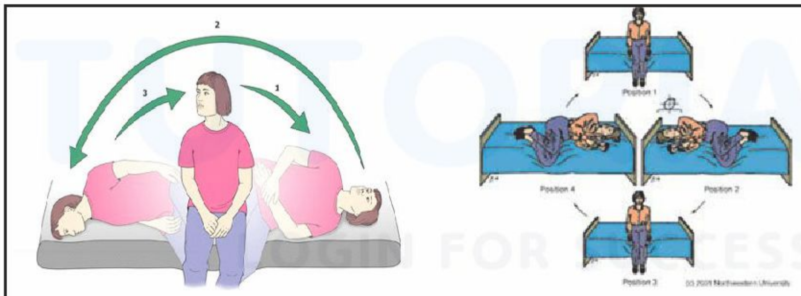
(Visual question) Fig: 7

Steps of Epleys maneuver

- Make the patient sit down.
- Turn the head 45° to the affected side.
- Make the patient lie down with head hanging off the table
- Rotate the head 90° to the other side.
- Rotate the body along with the head 90° on the same side.
- Make the patient sit down.

Other maneuver- Semont manoeuvre,

- If a patient has persistent symptoms after these maneuvers, the patient is advised to do Brandt-Daroff exercises.



Semont manoeuvre **Brandt- Daroff exercises.**

Fig: 8

- If a patient of BPPV does not respond to this treatment for months, then the patient gets chronic BPPV, this leads to recurrent disabling vertigo. Then this patient is a candidate for surgery called singular neurectomy (singular nerve supplies posterior SCC).

INNER EAR SEMICIRCULAR CANALS, VERTIGO AND CALORIC TEST

- There are three SCC.
  - Lateral SCC/ horizontal.
  - Posterior SCC.
  - Superior SCC.

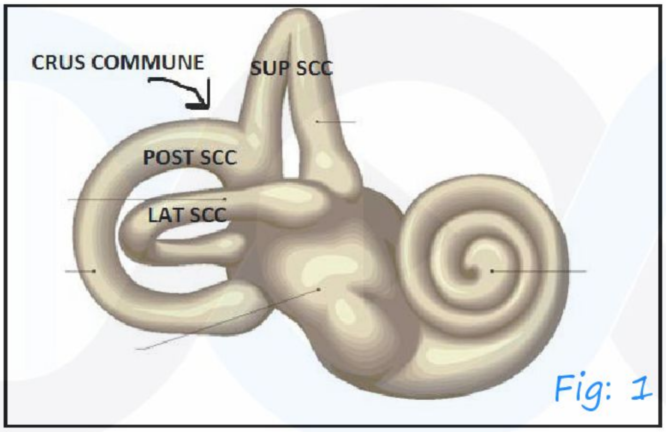


Fig: 1

Synergistic canal 00:01:20

- Synergistic canals- 3 pairs
  - Right - lateral semicircular canal & left- lateral semicircular canal. (R LSCC & L LSCC)
  - Right - posterior semicircular canal & left- superior semicircular canal. (R PSCC & L SSSC)
  - Left - superior semicircular canal & left - posterior semicircular canal. (L SSCC & R PSCCC)
- These 3 canals have Five openings, because one limb of posterior and superior fuse with each other, this is called CRUS COMMUNE.

- Function of canal- ANGULAR BALANCE.
- CRISTA- is the sensory end organ of a semicircular canal, it lies in the dilated end of a lateral semicircular canal which is called as AMPULLA. Crista is covered by a gelatinous layer called CUPULA.

Fitzgerald's bithermal caloric test 00:06:35

- This is a Test for Lateral SCC
- Steps-
  - Patient is lying supine with head lifted 30° (This brings lateral SCC in a vertical plane).
  - EAC is irrigated with Warm (44℃) and Cold (30℃) water.
  - This will produce nystagmus (Note the latency, duration, direction)
  - With cold water stimulation, eyes move towards the opposite side,
  - With warm water stimulation, eyes move towards the same side. (COWS).

Fitzgerald-Hallpike Bithermal Caloric Test

Fig: 2

Nystagmus 00:12:08

- Nystagmus-- few points to remember
- The basic reflex behind nystagmus is vestibulo-ocular reflex (VOR).
- Nystagmus has slow component and fast component.
- Slow component is by virtue of disease and fast component is the central corrective response.
- By rule the direction of nystagmus is always taken by fast component.

Electronystagmography (EMG) 00:14:25

- Electronystagmography (EMG) is electrical recording of nystagmus. Butterfly chart is used to plot the findings of ENG caloric test.
- In this chart, we plot the cumulative frequency of nystagmus.

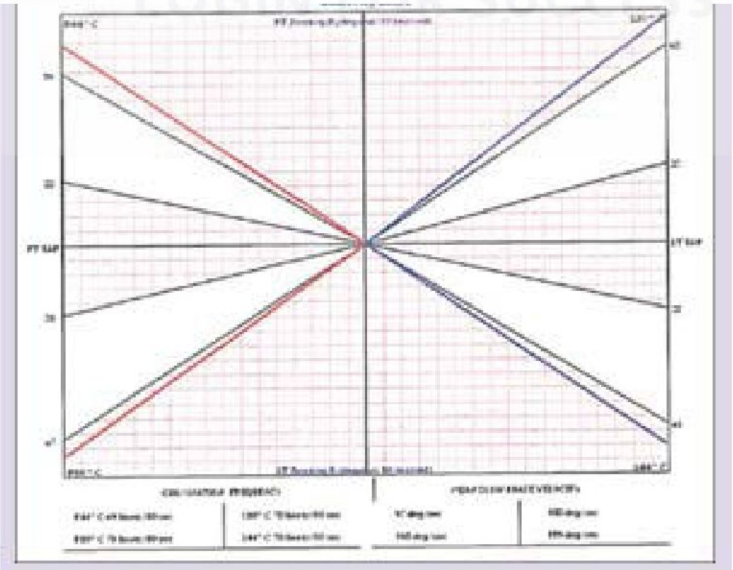


Fig: 3

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Butterfly chart

Frenzel glasses 00:18:00

- Frenzel glasses- are with +20 D lens.
- These glasses do not allow the gaze suppression of nystagmus, so it is easy to observe nystagmus with them.

Frenzel Glasses Fig: 4

Videonysterography (VMG) 00:19:40

- Videonystagmography (VMG)_is video recording of nystagmus

TUTORIALS LOGIN FOR SUCCESS

Videonystagmography (VNG) Fig: 5

Peripheral and central vertigo 00:20:04

Vertigo – causes

Peripheral causes of vertigo	Central causes of vertigo
• BPPV • Meniere's disease • Labyrinthitis • Ototoxicity • Superior canal dehiscence syndrome	• Migraine headache. • Multiple sclerosis. • Vestibular migrane • Cerebellar haemorrhage and infarct • Vertebrobasilar insufficiency • Vertebral artery dissection • Brain neoplasm.

Difference between peripheral and central vertigo

Peripheral vertigo	Central vertigo
Mostly sudden onset	Mostly gradual onset.
Intermittent with severe symptoms.	Constant with milder symptoms.
Affected by head position and movement.	Unaffected by head position and movement.
Nausea and vomiting are more frequent and severe.	Nausea and vomiting are less.

Motor function, gait and coordination typically intact.	Motor function, gait instability and loss of coordination frequent.

INNER EAR: VEMP, SUPERIOR SEMICIRCULAR CANAL AND BEHISCE

- In this test we stimulate the Saccule with loud sound and we record the electrical activity of sternocleidomastoid muscle.
- This reflex is called vestibulocollic reflex. VEMP is a test to detect function of inferior vestibular division of the 8th nerve. This nerve supply Saccule. (MCQ)
- Uses of VEMP-
- Acoustic neuroma.
- Superior semicircular canal dehiscence.

  - Meniere's disease.
  - Superior semicircular

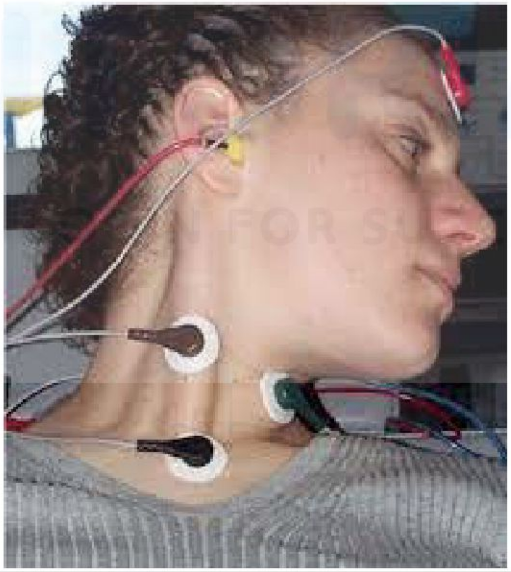


Fig: 1

Superior semicircular canal dehiscence syndrome 00:4:35

- Cause-
  - Congenital.
  - Traumatic or head injury.

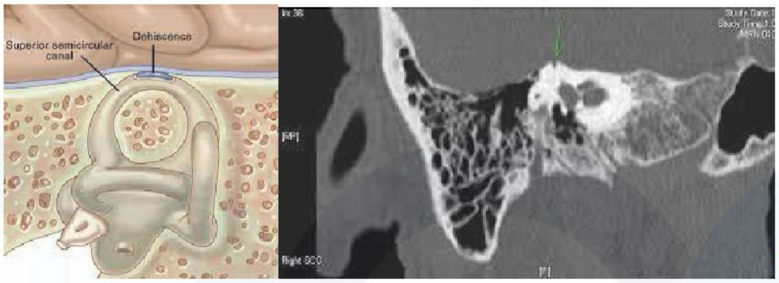


Fig: 2

Clinical picture

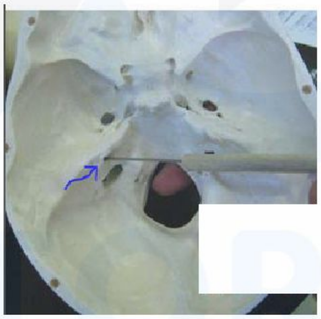
- This patient will have conductive hearing loss due to leakage of sound energy from this dehiscence. This is called THIRD WINDOW PHENOMENON.
- This patient will complain of vertigo on hearing loud sounds. This phenomenon is called Tullio's phenomenon.
- Investigations-
  - VEMP
  - HRCT temporal bone.
  - Treatment- surgical closure (graft to close dehiscence).

INNER EAR VC NERVE AND IAC, AUDITORY PATHWAY

- It has 3 divisions-
  - Cochlear division.
  - Superior vestibular division. (SV)
  - Inferior vestibular division. (IV)

Internal auditory Canal

- 7th and 8th nerves enter the ear via the Internal Auditory Canal also called internal auditory meatus.



Internal auditory canal Fig: 1

TUTORIALS LOGIN FOR SUCCESS

Cut section of internal auditory canal-

- BILL'S BAR- it is vertical bony septum in the upper part of the internal auditory canal.
- Facial nerve lies in anterosuperior compartment of internal auditory canal.

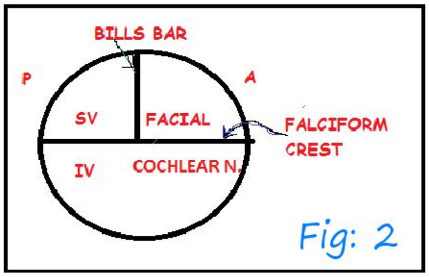

BILLS BAR
P
A
SV
FACIAL
FALCIFORM CREST
IV
COCHLEAR N.

Fig: 2

- SV -superior vestibular division of 8th nerve
- Iv- inferior vestibular division of 8th nerve

Auditory pathway (mnemonic --- ECOLI-MA)

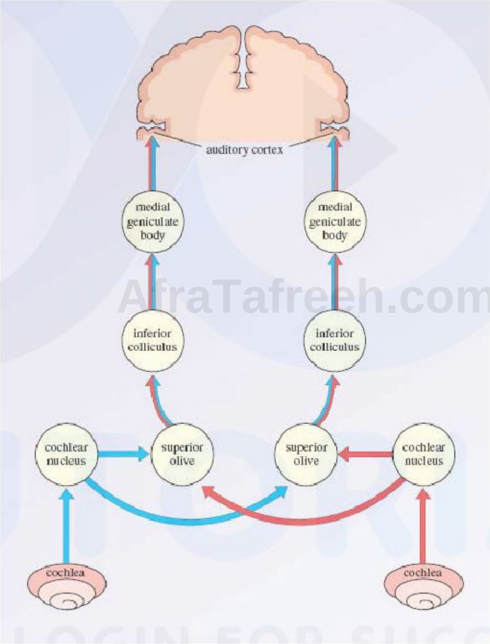

auditory cortex
medial geniculate body
medial geniculate body
inferior colliculus
inferior colliculus
cochlear nucleus
superior olive
superior olive
cochlear nucleus
cochlea
cochlea

Fig: 3

- It mainly lies in the brainstem area.
  - E- Eighth nerve.
  - C- Cochlear nucleus.
  - O- olivary complex(superior)
  - L- Lateral lemniscus
  - I - Inferior colliculus
  - M- Medial geniculate body

- A – Auditory cortex. – Auditory cortex lies in superior temporal gyrus
- The crossover of the fibres from one side to other side mainly happens at olivary complex (superior) area.

- 8th Nerve

↓

Cochlear nucleus

↓

Olivary complex superior

↓

Lateral lemniscus

↓

Inferior colliculus

↓

Medial geniculate body

↓

Auditory cortex

BASICS AND TUNING FORK TESTS

- Hearing loss is of 2 types-
  - Conductive hearing loss (CHL)
  - Sensorineural hearing loss (SNHL).
- SNHL is further of 2 types
  - Cochlear hearing loss due to cochlear diseases
  - Retro cochlear hearing loss due to 8th nerve diseases

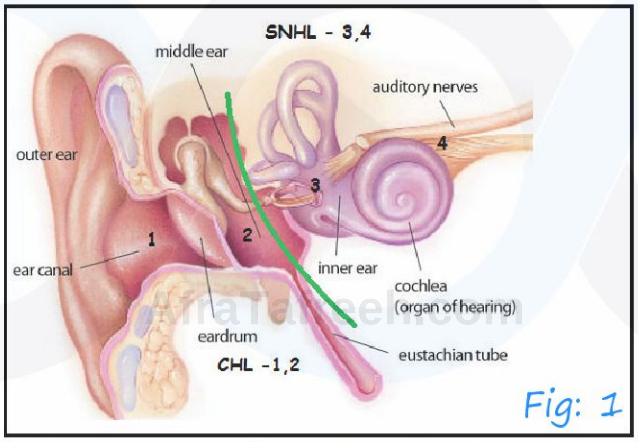

SNHL - 3,4
middle ear
auditory nerves
4
outer ear
3
1
2
ear canal
inner ear
cochlea
(organ of hearing)
eardrum
eustachian tube
CHL -1,2

Fig: 1

Conductive hearing loss	Sensorineural hearing loss-
problems in the external ear and middle ear cause CHL.	A problem in cochlea causes cochlear hearing loss. Eg- Meniere's disease.
Eg-wax, glue ear, CSOM, otosclerosis, Ossicular dislocation.	A problem with the 8th nerve will cause Retrocochlear hearing loss. Eg- Acoustic neuroma.

DOC TUTORIALS
LOGIN FOR SUCCESS

- Sound can be heard in 2 ways-
  - Air conduction (AC)- its natural way of hearing, complete test of hearing.
  - Bone conduction (BC)- it is a test; Bone conduction directly reaches cochlea. Therefore, bone conduction is a test of cochlea and 8th nerve only. If bone conduction is poor, patient has SNHL.

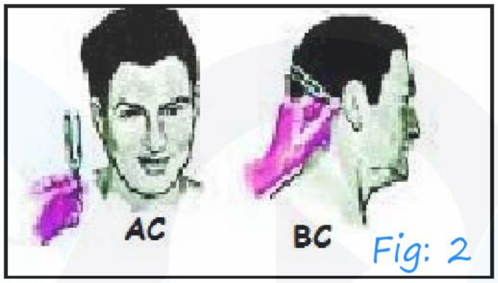


Fig: 2

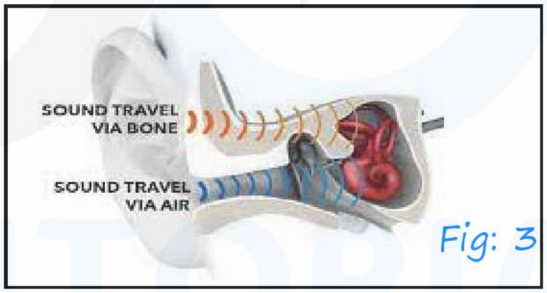


Fig: 3

Teminology in tuning fork test-

Poor ear means →	Ear with hearing loss.
Better ear means →	Ear with normal or better hearing.

- SNHL doesn't mean the patient is totally deaf. There can be mild, moderate severe or profound hearing losses. It means cochlea is working but less than normal.

Tuning fork test 00:14:45

- Tuning fork available in 256,512,1024 Hz. but most commonly used tuning fork 512Hz because of the following reasons.
  - It produces sound for a long duration (long decay time).
  - Produces less vibrations.

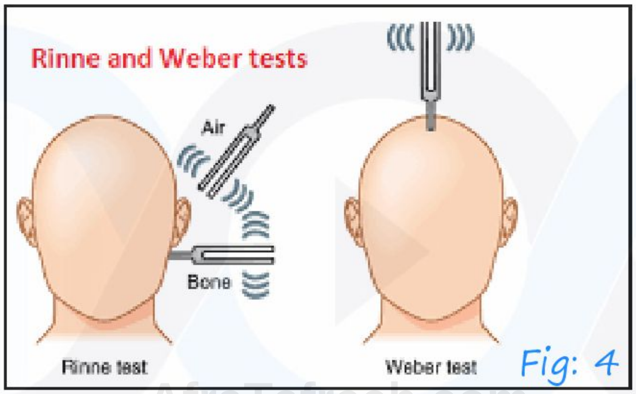


Fig: 4

Rinne test-

- It is a comparison of air conduction and bone conduction.

In normal people	AC>BC	[RINNE (+)].
In CHL	BC>AC	[RINNE (-)].
In SNHL	AC> BC	[RINNE (+)].

2.Weber test-

- Place the tuning fork centre of the head and ask the patient where sound is heard.

Normal people	Centre of forehead
CHL	Sound is heard in poor ear.
SNHL	Sound is heard in better ear.

3.Absolute bone conduction-

- This test is done with occluded EAC.

In normal people	is equal to examiner.
In CHL	is equal to examiner
In SNHL	it is decreased.

Points to remember for tuning fork tests

- RINNE (-) means conductive hearing loss.
- WEBER heard in poor ear means CHL.
- Bone conduction poor means SNHL (ABC).

Summary

	NORMAL	CHL	SNHL
Rinne	AC> BC (+)	BC> ac (-)	Ac>BC (+)
Weber	Heard in centre of forehead	Heard in poor ear	Heard in better ear
ABC	Equal to examiner	Equal to examiner	Decreased

What is false negative Rinne?

- **It is seen in Unilateral severe SNHL-**
  - This is due to trans-cranial migration of sound to the other ear when bone conduction is checked on the diseased site
  - This is corrected by masking the non-test ear (to keep the ear busy with other sounds). Instrument used for this is Barany's noise box.

Barany's noise box Fig: 5

Other tuning fork tests

- Gelles test and bing's test is used to diagnose otosclerosis
  - It's a special tuning fork test used to diagnose otosclerosis.

PURE TONE AUDIOMETRY(PTA)/ AUDIOGRAM

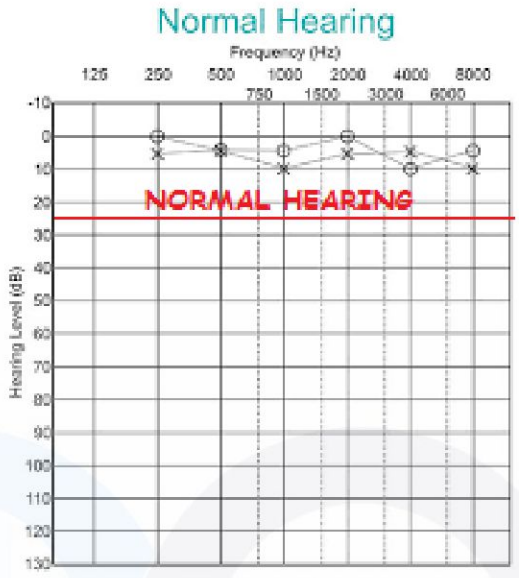


Fig: 1

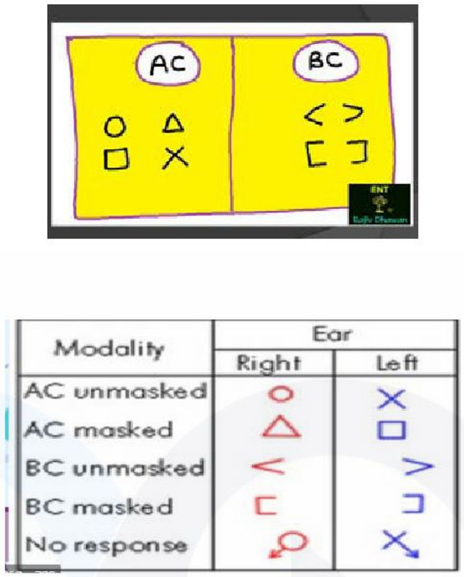
- It is a subjective test of hearing in air conduction and bone conduction.
- Frequencies tested are-

250	500	1000	2000	4000	6000	8000
Low	low			High	High	High

- Most important frequencies are 500Hz, 1000Hz and 2000 Hz.
- Hearing level up to 25dB is normal hearing.
- Blue lines are for the left ear.
- Red lines are for the right ear.

Symbols and lines used in PTA (Audiogram)

SYMBOLS


AC
○ △
□ ×
BC
< >
[ ]
ENT
Rajiv Dhawan

Modality	Ear	
	Right	Left
AC unmasked	○	×
AC masked	△	□
BC unmasked	<	>
BC masked	[	]
No response	○↙	×↘

Fig: 2

Lines

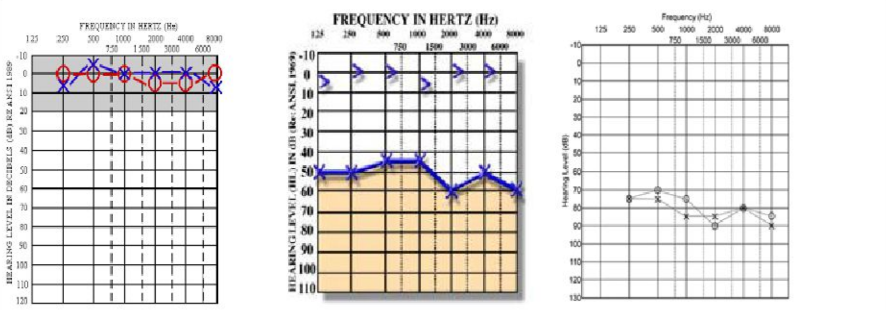
AC	is a continuous line ————
BC	is a broken line -------------

AfroTafreeh.com

- One interesting point to observe in Audiogram is that Upper line is always BC

Interpretation of Audiogram:

- Normal- both AC & BC are within 25dB range.
- CHL - AC is poor, BC is normal. AB gap (+) * (HALLMARK)
- SNHL - both AC, BC poor.



normal audiogram

CHL audiogram

SNHL audiogram

Fig: 3

- AB gap should be minimum 15dB to be significant.
- BC threshold should be always checked while masking the other ear (non-test ear).

Mixed hearing loss- (CHL+SNHL)

- PTA shows- both AC, BC poor with AB gap

Types of audiograms

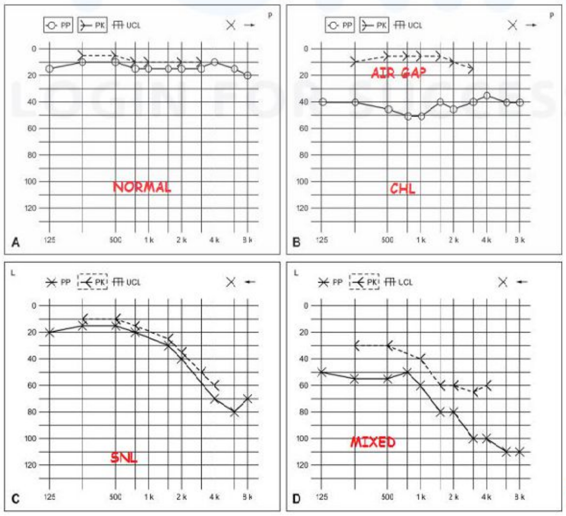


Fig: 4

DOT TUTORIALS
LOG IN FOR SUCCESS

Special dips in audiogram

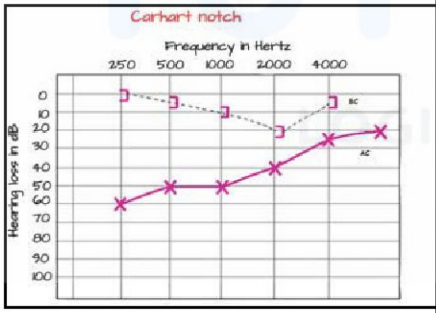
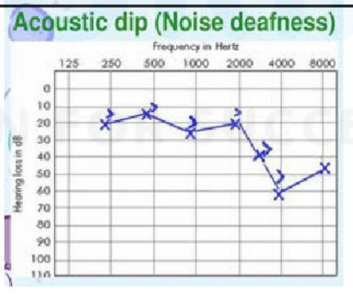
PTA

↓

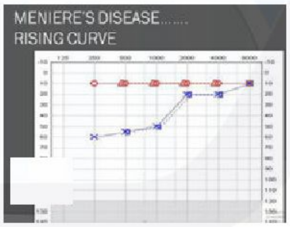
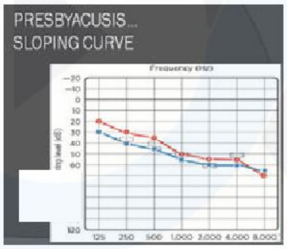
2 Special Dips

Dip at 2000 Hz in BC	Dip at 4000 Hz in BC
↓	↓
Otosclerosis	Noice induced HL
↓	↓
Carhart's Notch	Acoustic Dip

TUTORIALS
ORIGIN OF SUCCESS

Otosclerosis	Noice induced hearing loss
CHL (ab gap)	SNHL
Carhart's notch	Acoustic dip
Dip at 2000 Hz in BC	Dip at 4000 Hz in ac and BC
 Carhart notch	 Acoustic dip (Noise deafness) Fig: 5

Two special audiograms

Meniere's disease	Presbyacusis (Age related hearing loss)
SNHL. Unilateral disease MOSTLY. LOW FREQUENCY SNHL in early stages. Therefore, it shows rising audiogram.	SNHL. Bilateral disease. High frequency SNHL in early stages. Therefore, it shows sloping audiogram.
	 Fig: 6

How to differentiate cochlear (e.g. Meniere's disease) &_retro cochlear hearing loss (e.g. acoustic neuroma) 00:26:12

Tests are done

- Recruitment- It is abnormal perception of loudness.
- This phenomenon is seen in cochlear hearing loss. It is recorded using ABLB Test (ALTERNATE BINAURAL LOUDNESS BALANCING) also called Fowler's test.

- TONE DECAY TEST- it is a test of NERVE FATIGUE.

- Normal people - 60 sec.
- Retro cochlear hearing loss- 10sec(faster)

Short increment sensitivity index (SISI)

- How many short increments in sound patient can perceive

In normal people	30-50%
Cochlear hearing loss	>/= 70%

Speech Audiometry

- This test checks the understanding capability of the patient for heard words and we calculate Speech discrimination score (SDS)
- In Retro cochlear hearing loss SDS is poor (up to 40%) and ROLLOVER PHENOMENON is positive which means that on increasing sound intensity, SDS falls further.

Summary

- Tone decay is faster in Ret cochlear lesion
- Recruitment is seen in cochlear lesion
- SISI score in cochlear patient is more than normal
- In retrococ hearing loss, the SDS score is poor and Rollover Phenomenon is positive

BRAINSTEM EVOKED RESPONSE AUDIOMETRY-(BERA)

- It is an objective test of hearing.
- Principle- We stimulate the ear with sound and record electrical activity from the auditory pathway (it lies mainly in brainstem area).
- BERA has 7 waves. (I to VII)
- The most important wave of BERA is wave V, it is produced by lateral lemniscus.

Uses of BERA-

- Paediatric patients.
- Malingerers (MLC)
- To differentiate cochlear and retro cochlear hearing loss.

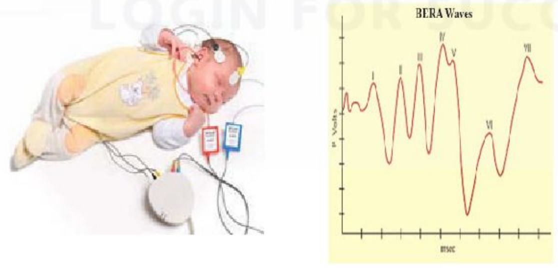


Fig: 1

Limitations of BERA

- BERA is frequency non-specific
- BERA does not check auditory cortex

Source of waves in BERA-

E	wave I & II
C	wave III
O	wave IV
L	wave V
I	wave VI & VII
M	wave VI & VII
A	Not checked in BERA. (*So BERA can miss CORTICAL DEAFNESS).

What is CERA & ASSR?

- CERA (Cortical Evoked Response Audiometry) is used for cortical deafness.
- ASSR (Auditory state study response) –This is frequency specific BERA.
- In BERA, the sound stimulus used is BROADBAND SOUND (non frequency specific sound). In ASSR, we give specific frequency sound stimuli and record the responses.

OAE (otoacoustic emissions) 00:08:47

- Emission means ECHOS.
- Principal- We give sound to ear and then we record echoes from outer hair cells of cochlea. These echoes are called OTOACOUSTIC EMISSIONS.
- If echoes are recorded it means cochlea is working normally

Fig: 2

Structure of organ of corti

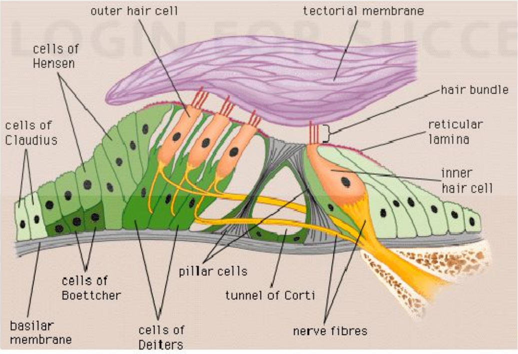

outer hair cell
tectorial membrane
cells of Hensen
hair bundle
cells of Claudius
reticular lamina
inner hair cell
pillar cells
cells of Boettcher
tunnel of Corti
basilar membrane
cells of Deiters
nerve fibres

Fig: 3

Inner hair cells	Single Layer, flask shaped.
Outer hair cells	more in number, cylindrical shaped, arranged in three layers.
Cells of dieters	They support the outer hair cell.
Tunnel of corti	It is the space separating the inner hair cell from outer hair cell.

OAE is of 3 types Depending on the number of sound stimuli used:

- 0 stimulus – it is called spontaneous OAE. (SOAE)
- 1 stimulus - it is called Transient evoked OAE (TEOAE)
- 2 stimuli - it is called Distortion product OAE (DPOAE). – best type

TEOAE are most commonly used in practice

- (MCQ). Ideal hearing screening investigation in
  - New-born baby or well-baby - OAE.
  - Meningitis baby or NICU baby (high risk baby) - BERA.
- In auditory neuropathy
  - OAE – normal
  - BERA – abnormal

Impedance audiometry 00:18:24

- It has 2 parts
  - Tympanometry
  - Stapedial Reflex

Tympanometry 00:18:50

Fig: 4

- This test records compliance (freedom of movement on change of EAC air pressure) of the middle ear system (TM & Ossicles).
- By recording the movement of Tympanic membrane and ossicles on change of EAC pressure, it will generate curves.
- It shows 5 types of curves.

TUTORIALS LOGIN FOR SUCCESS

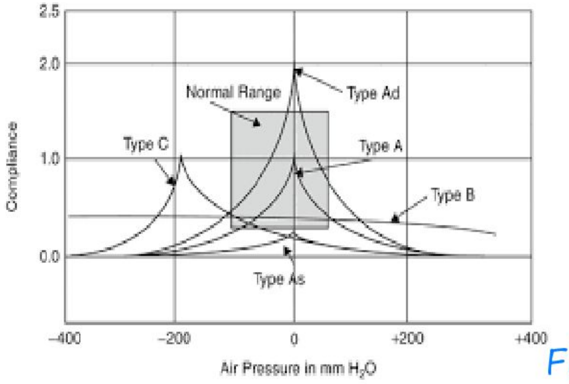


Fig: 5

Type A	Normal
Type B	Flat curve seen in Glue ear. (Or in perforated ear drum)
Type C	Seen in ET dysfunction or retracted tympanic membrane. This curve only comes on the negative side.
Type As	seen in OTOSCLEROSIS. It is a Low compliance curve.
Type Ad	seen in Ossicular dislocation. It is a high compliance curve (Open ended curve).

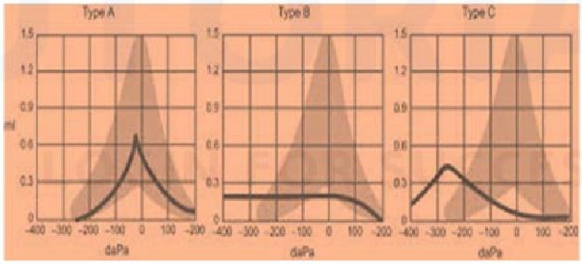


Fig: 6

Stapedial reflex-

- Principle-On hearing loud sound (8th nerve), Stapedial muscle contracts (7th nerve) to pull the stapes out of oval window so as to protect inner ear from damage due to loud sound.

- Afferent of this reflex is 8th nerve, efferent is 7th nerve.
- This reflex is absent in
  - Deaf patients (8th nerve is gone).
  - Bell's palsy (7th nerve problem).
  - Otosclerosis.

Electrocochleography (EcochG) 00:36:50

- It is a special investigation used to diagnose Meniere's disease.

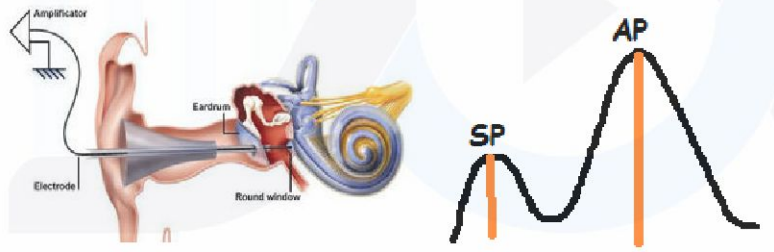


Fig: 7

Principle

- Give sound stimulus to the ear and record electrical activity from the promontory (projection of basal turn of cochlea). It is done by passing an electrode through a tympanic membrane and touching the tip of the electrode to promontory.
- There are 2 electrical activities recorded
  - Summation potential. (SP)
  - Action potential. (AP)
- The main thing to be calculated is SP:AP ratio

- This ratio </=30% is seen in normal people.

>30%	Indicative of Meniere's disease.
>/=45%	Highly suggestive of Meniere's Disease

- However, please note that it is only a supportive test, not diagnostic. Meniere's disease is diagnosed clinically

Summary of concepts of electrophysiology tests

BERA	We record electrical activity from the brain.
ECochG	We record electrical activity from the cochlea.
OAE	We record echoes from cochlea.
VEMP	We record electrical activity from sternocleidomastoid muscle.

MISCELLANEOUS DISORDERS OF EAR

Temporal bone fracture 00:00:12

Cause – trauma

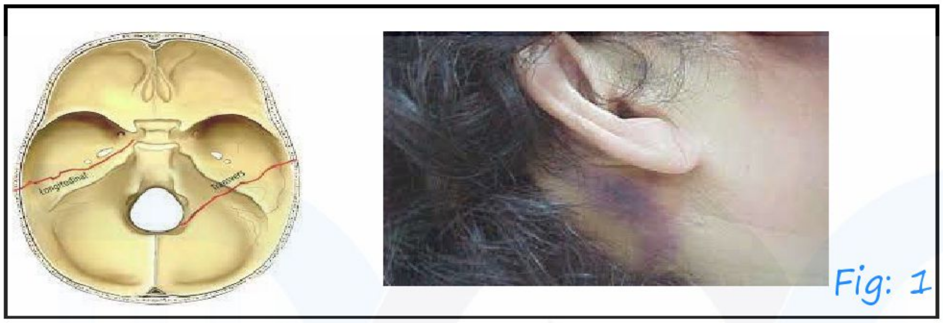


Fig: 1

BATTLE SIGN - it is ecchymosis in the mastoid region. It is seen in skull base fractures (temporal bone fractures).

Temporal bone fracture are two types:

Longitudinal fracture	Transverse fracture
This is due to falling on the side. 80% of total fractures. Less dangerous.	due to Fall on front or the back. 20% of total fractures. More dangerous.
Cause Ossicular dislocation.	Damage cochlea. Cause SNHL

Cause CHL Vertigo is uncommon. EAC bleeding and CSF otorrhoea are more common	Vertigo is common.
Facial palsy is less common and delayed in onset, it is due to edema of nerve. So, treatment is oral steroids	EAC bleeding and CSF otorrhoea are less common. Facial palsy is more common and immediate in onset, it is due to direct injury to nerve by fracture line. So, treatment is immediate surgery.

Traumatic ossicular dislocation 00:12:28

- TEMPORAL bone fracture can lead to ossicular dislocation, most common ossicle dislocation is INCUDOSTAPEDIAL joint.
- There can be 2 possibilities in ossicular dislocation leading to conductive hearing loss---
  - Ossicular dislocation with normal tympanic- 54dB CHL.
  - Ossicular dislocation with Perforated tympanic membrane - 38dB CHL. (through the hole, some sound will also be able to directly enter in the middle ear, so less hearing loss)

General points to remember

- CHL due to Wax – 30dB CHL.
- CHL in Glue ear – 10 to 40 dB CHL.

What is Ice Cream Cone appearance in CT Temporal bone?

- On HRCT of temporal bone of a normal person, ICE CREAM CONE APPEARANCE is seen.
- IT is seen at the level of Incudomalleal joint on axial cuts in CT.

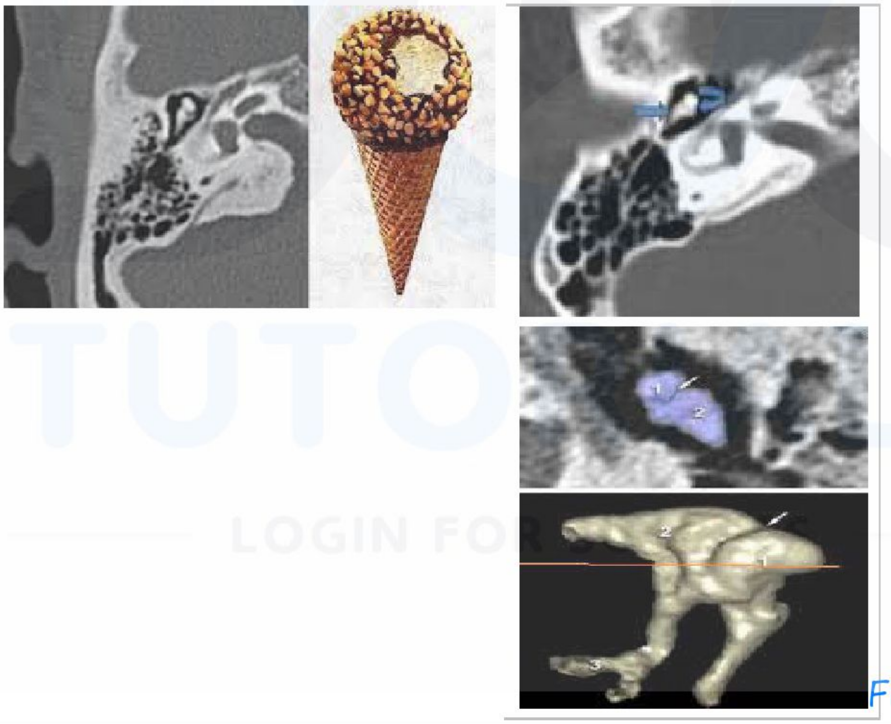


Fig: 2

Sudden SNHL 00:17:38

Definition-

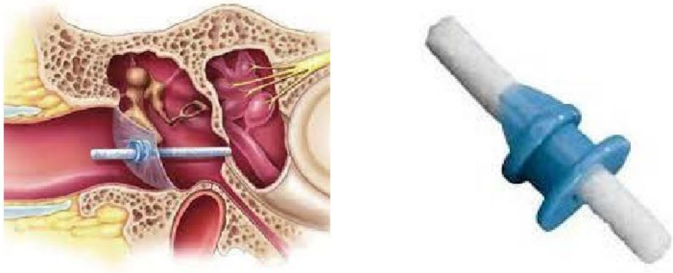
- it is defined as sudden hearing loss of minimum 30dB
- it should be visible in at least 3 continuous frequencies in PTA
- It should have happened within 3 days.
- It's unilateral. And has Unknown etiology.

Hypothesis-

- Inflammatory cochleitis.
- Viral cochleitis.
- Autoimmune disease.
- Vascular cause.

Treatment –

- DOC- oral steroids.
- Other treatments-
- Transtympanic injection of dexamethasone (using MICROWICK).
- Hyperbaric oxygen therapy.



MICROWICK Fig: 3

Noise induced hearing loss

- Permissible level of noise in industry is 85dB, 8 hours a day, 5days a week.
- Acoustic dip, is seen in audiogram in noise induced hearing loss. It is seen in both AC & BC at 4000Hz.

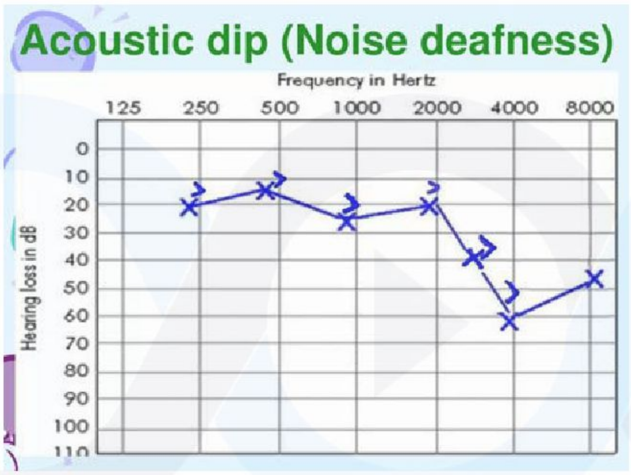


Fig: 4

OTOTOXICITY (drug induced hearing loss)

00:27:05

- Aminoglycoside- eg- Amikacin, Streptomycin, Gentamicin.
- Loop diuretics- eg- Furosemide, ethacrynic acid. (Act at stria vascularis of cochlea)
- Antimalarials- eg- Chloroquine, Quinine.
- NSAIDs- eg- Aspirin, Ibuprofen, Indomethacin.
- Anticancer- eg- Cisplatin, Carboplatin.
- Deferoxamine.
- Vancomycin.
- Erythromycin.

- Reversible Ototoxicity- seen in Aspirin, diuretic, antimalarials.
- Ototoxicity shows High frequency SNHL in early stages, therefore
- High frequency audiometry is a special test used to diagnose Ototoxicity.

GLOMUS JUGULARE

- It is a type of Paraganglinoma.
- Other eg- pheochromocytoma, chemodectoma (carotid body tumor), Glomus Vagale, Glomus Tymanicum
- RULE OF 10% for all Paraganglinoma
- 10% multicentric.
- 10% familial.
- 10% bilateral.
- 10% can be secretory.
- (They secrete catecholamines, so 24 hours urinary VMA levels are checked in Glomus Jugulare also.)

Glomus jugulare

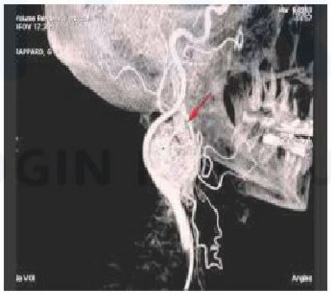


Fig: 1

- It is benign non capsulated locally invasive highly vascular tumour.
- It is a highly vascular tumor. It is more common in females.

- Site of origin- it arises from glomus cells lying around the jugular bulb.

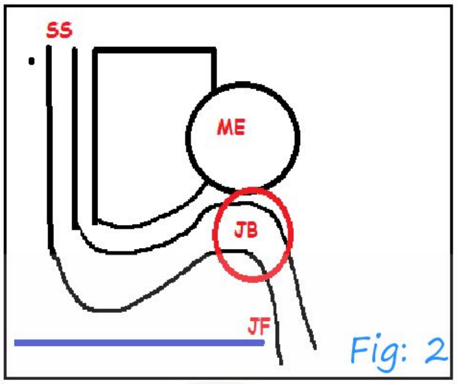


Fig: 2

- It is skull based jugular foramen tumour.
- The red vascular tumor erodes the floor of the middle ear and moves into hypotympanum. This is called the RISING SUN SIGN.

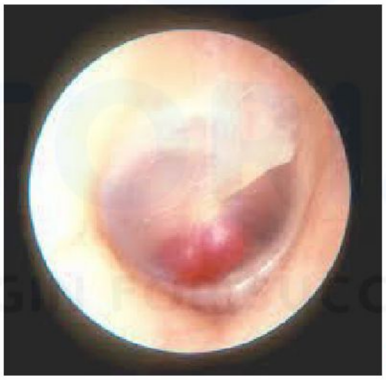


Fig: 3

- The tumor now erodes the tympanic membrane and grows into external auditory canal leading to bleeding ear mass or reddish pulsatile ear mass which bleeds to touch
- The tumour eventually erodes the wall of the middle ear and enter mastoid area.

- At the skull base it is a Jugular foramen tumor. This tumor will erode the bony septum between the carotid canal and jugular foramen. This finding on CT scan called PHELP SIGN

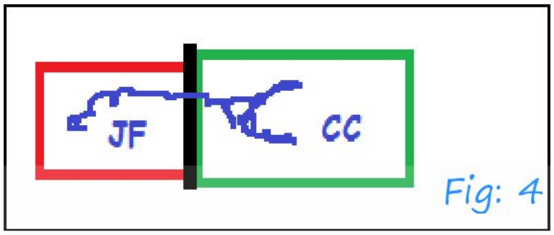


Fig: 4

- Later, the tumor will have an intracranial extension.
- 4% of this tumor can lead to metastasis.
- It is a jugular foramen tumor. Hence involvement of 9,10,11th nerves is common.
- Facial nerve involvement can be also seen.

TUTORIALS LOGIN FOR SUCCESS

Fisch staging of glomus jugulare- 4 types (A, B, C, D)

- Tumor limited to middle ear.
- Middle ear + mastoid
- Carotid canal.
- Intracranial extension

Fisch classification

- Type A – Tumor limited to Middle Ear (carries the best prognosis)
- Type B – Tumor limited to the Tympanomastoid area with no infralabyrinthine compartment involvement

- Type C – Tumor involving the Infralabyrinthine Compartment of temporal bone with extension to petrous apex
  - Type C1 – Tumor with limited involvement of the vertical portion of the carotid canal
  - Type C2 – Tumor invading the vertical portion of the carotid canal
  - Type C3 – Tumor invasion of the horizontal portion of the carotid canal
- Type D – Tumor with Intracranial Extension
  - Type D1 – Tumor with an intracranial extension less than 2 cm in diameter
  - Type D2 – Tumor with an intracranial extension greater than 2 cm diameter

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Chief complaint 00:21:17

- Female patient with pulsatile tinnitus. This tinnitus is synchronous with pulse.
- Bleeding red ear mass.

Examination 00:23:25

- RISING SUN SIGN.
- Red ear mass which bleeds on touching. This tumor blanches on seigelisation. This is called BROWN SIGN.

- Pulsatile mass in the ear, these Pulsations will disappear on pressing carotid arteries. This is called AQUINO SIGN.

Investigations 00:26:15

- Biopsy is contraindicated.
- CT scan will show PHELP SIGN. It is erosion of bony septum between carotid canal and Jugular Foramen.
- MRI to rule out intracranial extension.
- MR Angiography - to find out the main source of blood supply for this tumor. Most common blood supply to this tumor is ASCENDING PHARYNGEAL ARTERY. Pre-operative embolisation will reduce blood loss during surgery.

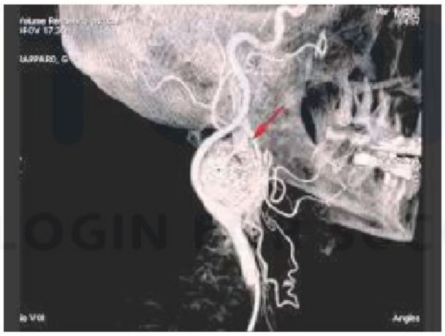

Fig: 5

Treatment 00:29:48

- Treatment-
  - Treatment Of choice is surgery.
  - Gamma knife therapy is 2nd option.

Glomus tympanicum

- If a similar tumor found to be arising from glomus cells lying around promontory (bulge on medial wall of middle ear). Then this tumor is called glomus tympanicum

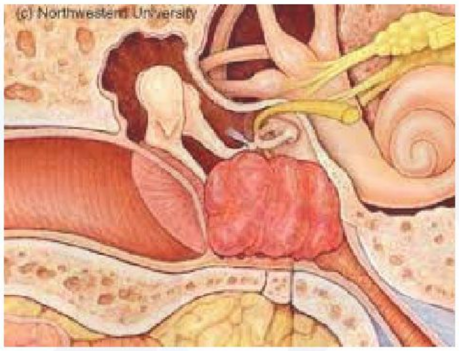
(c) Northwestern University

Fig: 6

OTOSCLEROSIS/ OTOSPONGIOSIS (EARLY STAGE)

Otosclerosis/ autopoiesis (early stage) 00:00:08

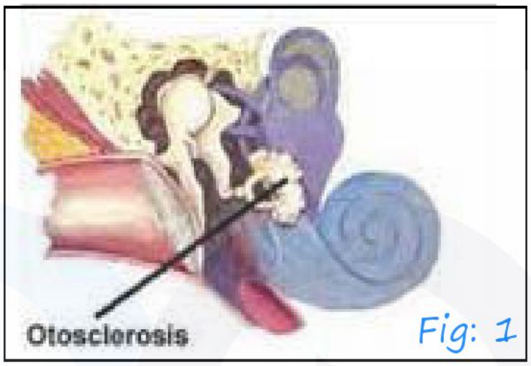

Fig: 1

- It is a fixation of the footplate of stapes. (Piston like movement is stopped)
- It is a disease of otic capsule
- Otic capsule is where stapes footplate and cochlea also originate from.
- In otosclerosis, the dense endochondral bone of otic capsule is replaced by spongy bone (woven bone) which is later replaced by more of mature bone

Histopathology of Otosclerosis

- In otosclerosis, the dense endochondral bone of otic capsule is replaced by spongy bone (woven bone) which is later replaced by more of mature bone
- So, the early stage of otosclerosis is called autopoiesis. There will be enlargement of

perivascular spaces. This will give pinkish appearance to the disease focus in early stages. Now there will be active remodelling of spongy bone and connective tissues deposition. This will be followed by production of more mature bone. Histopathological examination picture of otosclerosis is called BLUE MANTLES on H&E staining.

- Resorption of enchondral bone with enlargement of perivascular spaces followed by deposition by immature (spongy) bone and a lot of cement substance/connective tissue stroma which stains blue with haematoxylin-eosin stain

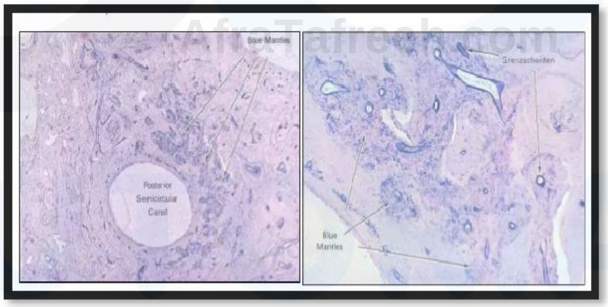

Fig: 2

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Disease Profile: 00:08:52

- It is more common in females (2-3rd decade.). In India it is more common in males.
- Mostly Bilateral.
- Genetic disease- Autosomal dominant.
- It is gradually progressive disease, but pregnancy aggravates it.

- Most common site of origin is FISSULA ANTE FENESTRAM. It is a point anterior to the oval window.
- Initial stage of disease is pink in color, this stage is called otospongiosis. It gradually turns White (otosclerosis).
- In the next few years, the disease will surround the footplate from all-around.
- Measles viral infection may initiate the conversion of dense bone to spongy bone. (a hypothesis only)

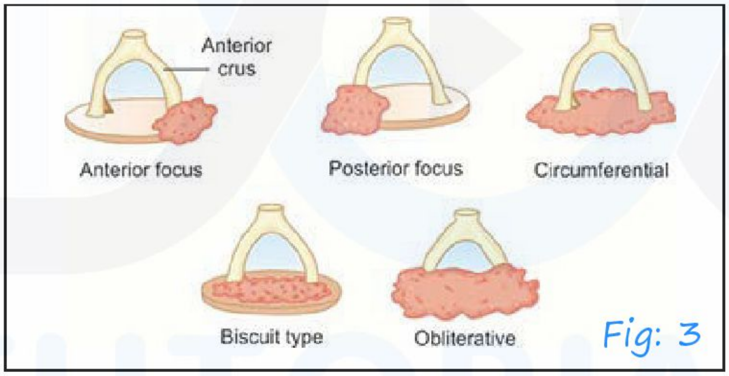
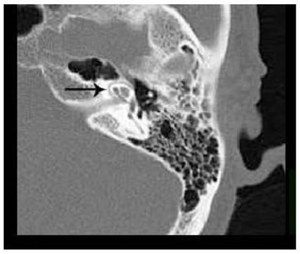

Anterior crus
Anterior focus
Posterior focus
Circumferential
Biscuit type
Obliterative

Fig: 3

- Types of otosclerosis-
  - Anterior focus
  - Posterior focus
  - Circumferential focus
  - Biscuit type.
  - Obliterative type
- Rarely otosclerosis can also involve cochlea which will lead to cochlear otosclerosis. This will lead to mixed hearing loss (CHL+SNHL). CT scan of cochlear otosclerosis shows DOUBLE RING SIGN.



Double ring sign of cochlear otosclerosis Fig: 4

Clinical Picture

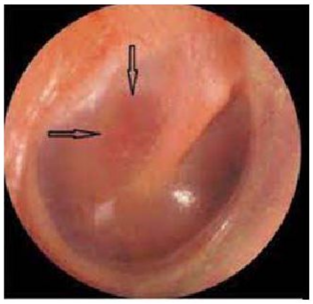
- A young female with bilateral gradually progressive CHL is most common clinical profile of this patient

Other symptoms-

- Patients hear better in noisy areas, this is called PARACUSIS WILLISII. (MCQ)
- Low tone voice.
- +/- Tinnitus (ringing sensation in ear).

Examination 00:20:00

- 90% of patients show normal Tympanic Membrane.
- 10% of patients show SCHWARTZ SIGN.
- Schwartz sign is in Early stages. It is Flamingo pink appearance behind tympanic membrane.



Schwartz sign Fig: 5

Investigations 00:22:09

- PTA – CHL+ Carhart's Notch (dip at 2000Hz in BC).
- Tympanometry– shows Type As curve.
- Absent stapedial reflex.

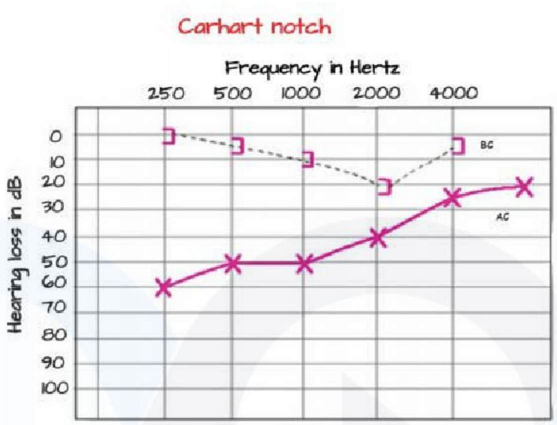


Fig: 6

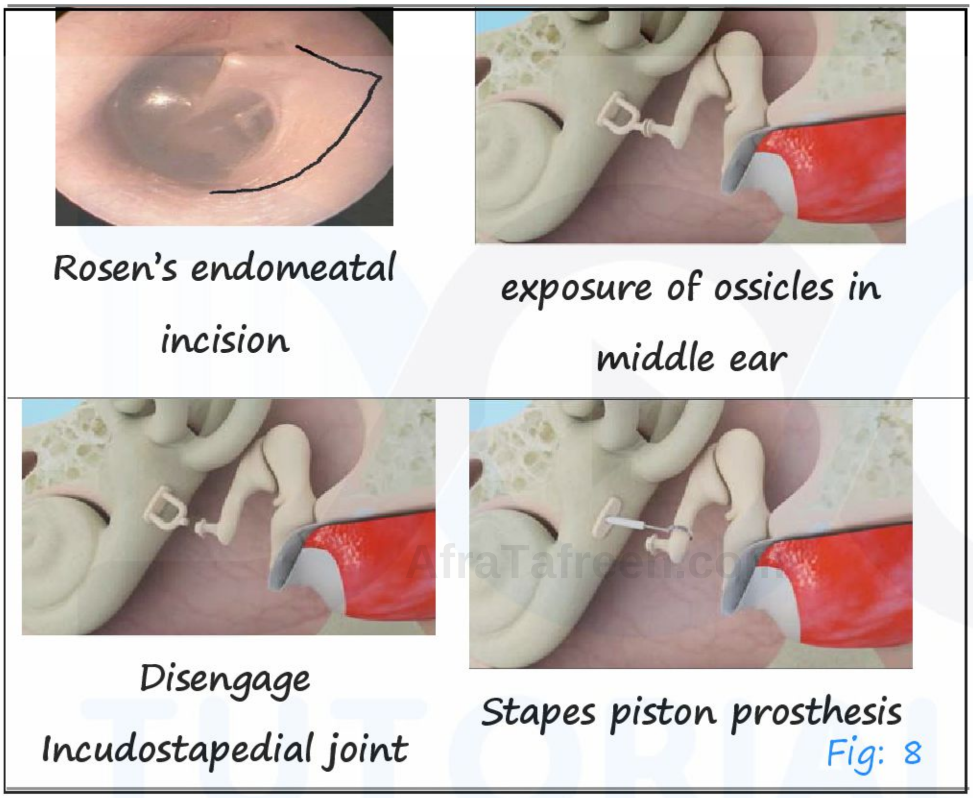
Treatment 00:24:30

- Treatment – treatment of choice is surgery called Stapedotomy
  (Stapedectomy is alternative surgery)

Steps of Stapedotomy

- Rosen's endomeatal incision.
- Expose the ossicles in middle ear.
- Disengage Incudostapedial joint.
- Remove the head of the stapes.
- Make a hole in the footplate of stapes.
- Place stapes piston prosthesis (looks like question mark.). It is made up of titanium or Teflon.

Fig: 7



Rosen's endomeatal incision

exposure of ossicles in middle ear

Disengage Incudostapedial joint

Stapes piston prosthesis

Fig: 8

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TUTORIALS
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Othertreatment-

- Hearing aid- is given for patients unwilling for surgery.
- Sodium fluoride (NaF) oral therapy. It is treatment of choice for
- Schwartz sign (+) patient. (Early stage of disease)
- Cochlear otosclerosis.
- NaF leads to stabilization of disease.

Mechanism of action of NaF

- It increases osteoblastic activity,
- It decreases osteoclastic activity,
- It inhibits proteolytic enzymes.

Contraindication Of NaF

- Pregnancy, Lactation, Flourosis, Renal disease.

Van der hoeve syndrome 00:33:55

- Osteogenesis imperfecta.
- Otosclerosis.
- Blue sclera.

ACOUSTIC NEUROMA / VESTIBULAR SCHWANNOMA

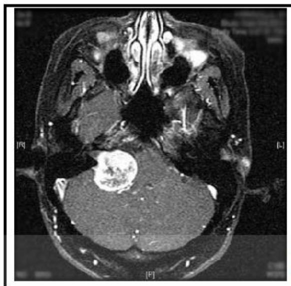


Fig: 1

- It's a benign slow growing tumor of the 8th nerve.
- Most common site of origin is inferior vestibular division of 8th nerve.
- It is mostly unilateral except in NEUROFIBROMA TYPE II (bilateral vestibular schwannoma)

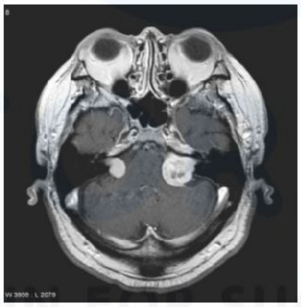


Fig: 2

- It's a brain tumor.
- It is the most common type of Cerebellopontine angle tumour.
- It is equally common in male and females.
- It is common in the 4th-5th decade.
- Ear examination is normal in these patients

Clinical Picture 00:6:15

- Unilateral, gradually prossive SNHL (retro cochlear type).
- Tinnitus.
- Imbalance.

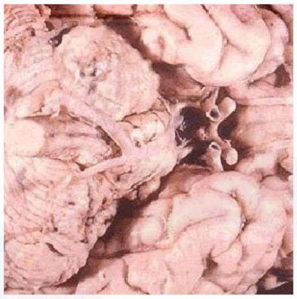


Fig: 3

Cranial nerve involvement occurs in this sequence

- 8th nerve
- Trigeminal nerve (5th nerve) - absent corneal reflex. MCQ
- Motor division of facial nerve- it is thick, so rarely involved, therefore facial palsy is rare.
- Sensory division of facial nerve --This will lead to HITZELBERGER SIGN (it is loss of sensation in posterosuperior surface of EAC.)
- Motor division of facial nerve- it is thick, so rarely involved, therefore facial palsy is rare.
- 9,10,11,12 cranial nerve (lower cranial nerves).
- Cerebellar compression seen in terminal stages
- On ear examination, it is normal

TUTORIALS LOGIN FOR SUCCESS

Investigations 00:15:32

- PTA- unilateral SNHL.
- Tone decay- faster.
- SDS (speech discrimination score)- poor (40%)
- Roll over phenomenon is positive.
- BERA- delayed wave V. (latency of wave V will be increased)
- Interaural latency difference of wave V
- Latency of wave V in BERA of disease ear MINUS the latency of wave V of normal ear.
- If this difference >0.2 m sec, it is indicative of acoustic neuroma
- Best radiological investigation is Gadolinium enhanced MRI.

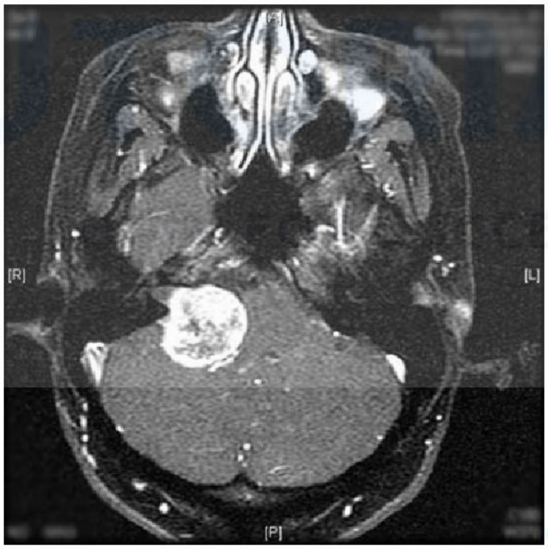


Fig: 4

TREATMENT 00:24:17

Treatment- surgery → 2 approaches

ENT approach	Neurosurgery approach
Translabyrinthine approach	Middle cranial fossa approach
This is good for large tumors with no residual hearing,	This is good for small tumors with residual hearing
no hearing preservation possible	Hearing preservation is possible.

Other treatment option

- Gamma knife therapy- it is GAMMA radiation based stereotactic radiotherapy

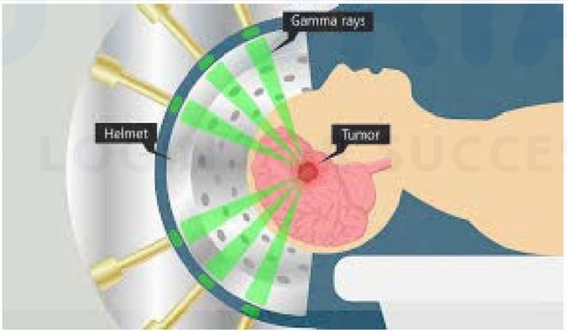


Fig: 5

Indications of Gamma Knife

- patient unwilling for surgery.
- Patient unfits for surgery.

- Old patient with a small tumor with residual hearing.
- Limitations of Gamma Knife
- Radiation exposure,
- it only shrinks the tumor so, 2nd or 3rd sitting is required.

MENIERE'S DISEASE

- Endolymph is produced by stria vascularis of cochlea and it is absorbed by the endolymphatic sac

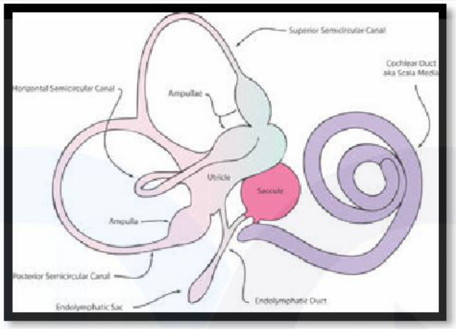

Superior Semicircular Canal
Cochlear Duct
aka Scala Media
Horizontal Semicircular Canal
Ampullae
Utricle
Saccule
Ampulla
Posterior Semicircular Canal
Endolymphatic Sac
Endolymphatic Duct

Fig: 1

- In Meniere's disease, there is a rise in endolymph volume due to poor absorption by endolymphatic sac.

Endolymphatic sac and Vestibular Aqueduct -- Anatomy

- Endolymphatic duct pierces through the petrous part of temporal bone and comes out of temporal bone, it reaches the temporal fossa where the end of the duct makes dilatation which is called endolymphatic sac. Endolymphatic sac lies in epidural space in posterior cranial fossa
- The bony cover of endolymphatic duct is called VESTIBULAR AQUEDUCT.

Patient and disease profile

- It is mostly unilateral disease.
- Slightly more common in males.
- Seen in 3rd to 4th decade
- Etiology is unknown.
- It is an episodic disease. Its duration is less than 24 hrs.

During Episode

- Episode has 3 features
  - Tinnitus- it is the first symptom.
  - Vertigo.
  - Hearing loss.
  - +/- Fullness in ear
- LERMOYEZ SYNDROME- rare condition of Meniere's where hearing loss is followed by vertigo. (Reverse Meniere's disease)
- During episodes some people fall down without turning unconscious, this is called TUMARKIN'S CRISIS.
- During an episode some patients can develop diarrhea.
- Episode finishes within 24hrs.

In between episodes

- Tinnitus may persist
- Patient hears loud sounds as louder. This is called RECRUITMENT PHENOMENON.
- Patients can get vertigo on hearing loud sounds. This is called TULLIO'S PHENOMENON.
- Patients have a dislike for noisy areas.
- Patients hear the same sound in 2 frequencies. This is called DIPLACUSIS.

FEW YEARS LATER

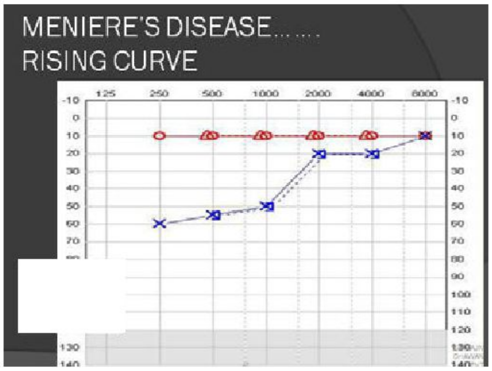
- Cochlear damage starts due to high endolymphatic pressure (glaucoma of ear). This leads to hearing loss in between episodes also. This will lead to fluctuating hearing loss. It leads to low frequency SNHL in early stages

Investigations 00:22:08

(Please see Audiology section for details)

1. PTA (pure tone: audiometry) - unilateral SNHL (Low frequencies SNHL in early stages). This will lead to a rising audiogram.

DBMCI TUTORIALS LOGIN FOR SUCCESS



MENIERE'S DISEASE…….
RISING CURVE

Fig: 2

2.ORAL GLYCEROL TEST (DEHYDRATING AGENT)

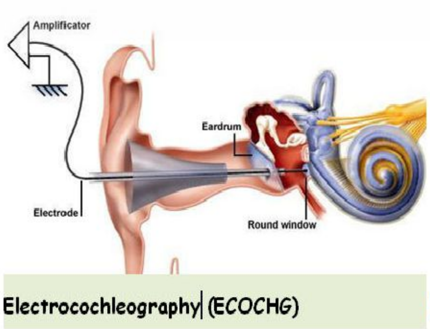
- Repeat PTA after 2 hrs of giving oral glycerol.
- Improvement of more than 10dB incdicates test is positive.

3.RECRUITMENT PHENOMENON is positive. (ABLB Test)

4.SHORT INCREMENT SENSITIVITY INDEX (SISI)

In normal people	30-50%
Cochlear hearing loss (Meniere's Ds)	>/= 70%

5.Electrocochleography (ECOCHG) - SP: AP Ratio >30%



Amplificator
Eardrum
Electrode
Round window
Electrocochleography (ECOCHG)

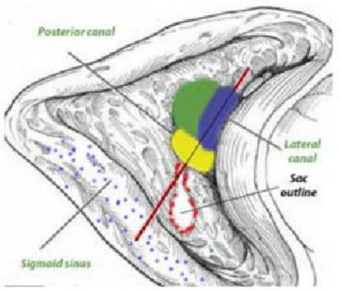
Fig: 3

Treatment 00:29:50

- During episode- anti vertigo medications. E.g.- prochlorperazine, cinnarizine.
- In between episode-
  - Acetazolamide (diuretic)
  - Low salt diet.

If episodes of vertigo become more frequent and disabling

- Further treatment options Think of 2 scenarios
  a. If residual hearing is present-
    1. VESTIBULAR NEURECTOMY- Transect the vestibular branch of 8th nerve to control vertigo symptoms
    2. ENDOLYMPHATIC SAC SHUNT/ DECOMPRESSION SURGERY - Donaldson's line is surgical landmark for Endolymphatic sac. It is a line along the lateral semicircular canal which bisected the posterior semicircular canal. The endolymphatic sac lies below this line.


Posterior canal
Lateral canal
Sac outline
Sigmoid sinus

Donaldson's line

Fig: 4

3.MENIETT DEVICE

- It is Intermittent low pressure pulse therapy for inner ear.

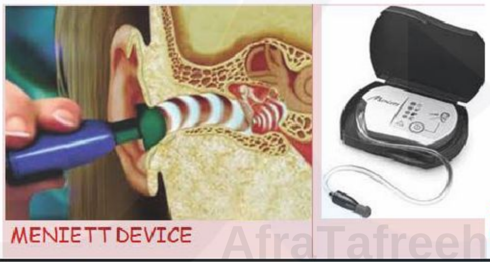

MENIETT DEVICE

Fig: 5

b. If no residual hearing is there

1.TRANSTYMPANIC GENTAMICIN INJECTION

This injection is given using MICROWICK.

Gentamicin is an Ototoxic drug. This injection will lead to Chemical labyrinthectomy.

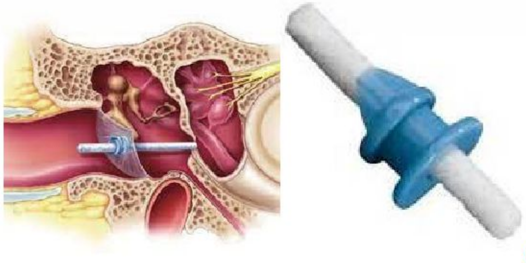


Fig: 6

MICROWICK

2.SURGICAL LABYRINTHECTOMY.

ANATOMY OF FACIAL NERVE

- It originates from pons and enters the temporal bone via internal auditory canal (internal auditory meatus) and it comes out through stylomastoid foramen, then it goes to parotid gland, there it divides into 2 major trunks.
- Upper one is Zygomatico-facial and the lower one is the Cervico-facial trunk which is further divided into 5 branches to supply facial muscles.
- In the ear the facial nerve travels through a bony canal which is known as fallopian canal or facial nerve canal.
- 3 segments of facial nerve canal

  1.LABYRINTHINE SEGMENT- its length is 3-4mm. It is the narrowest segment; therefore, it is also called physiological bottle neck of facial nerve.

  2.TYMPANIC SEGMENT- also called as horizontal segment.

  It is 11mm in length. It lies on the medial wall of the middle ear. It is from 1st genu to 2nd genu (genu means turn or bend). This segment has the highest incidence of natural dehiscence of the bony facial nerve canal. 1st genu contains ganglion called GENICULATE GANGLION.

  3.MASTOID SEGMENT (vertical segment)

  Lies on the posterior wall of the segment

TUTORIALS LOGIN FOR SUCCESS

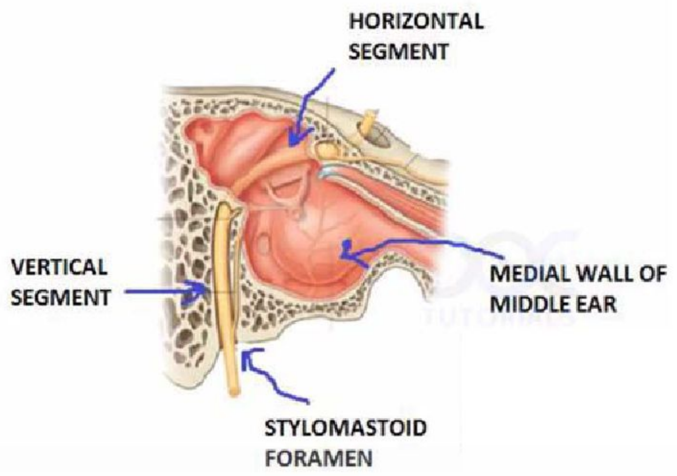

HORIZONTAL SEGMENT
VERTICAL SEGMENT
MEDIAL WALL OF MIDDLE EAR
STYLOMASTOID FORAMEN

Fig: 1

Three Branches of Facial Nerve 00:12:50

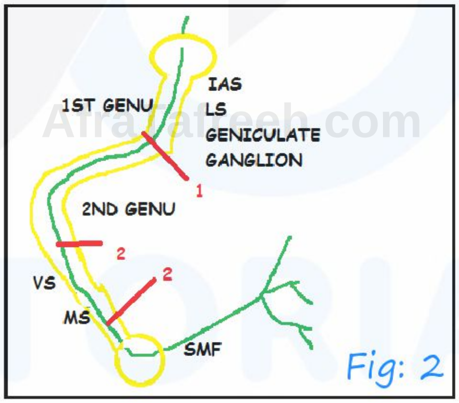
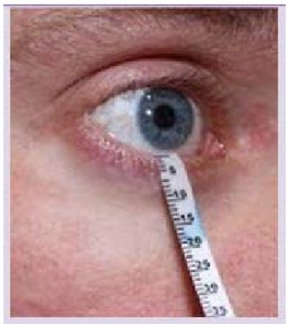

IAS
1ST GENU
LS
GENICULATE GANGLION
1
2ND GENU
2
2
VS
MS
SMF

Fig: 2

1.Greater superficial Petrosal nerve

- It arises from the 1st genu.
- It gives the secretomotor supply to the lacrimal gland and nasal glands.
- Test of this nerve is the SCHIRMER's TEST OF LACRIMATION.



Schirmer's test of lacrimation Fig: 3

2.Nerve to Stapedius-

- It arises from 2nd genu.
- Test for this nerve is a Stapedial reflex.

3.Chorda tympani Nerve-

- It arises from the vertical segment or mastoid segment of the facial nerve.
- It passes between malleus and incus in the middle ear cavity and exits through CANAL OF HUGUIER (it lies in petrotympanic fissure). It supplies
  a. Taste sensation to anterior 2/3rd of tongue.
  b. Submandibular and sublingual gland.
- Test for this nerve is taste sensation.

TUTORIALS LOGIN FOR SUCCESS

FACIAL RECESS 00:24:25

It is on the posterior wall of middle ear

- Boundaries-
  1. Lateral - chorda tympani nerve.
  2. Medial- vertical segment of facial nerve.
  3. Superior- short process of incus. (Fossa Incudis)
- Surgical importance- facial recess is a surgical landmark for posterior tympanotomy.

BELL'S PALSY

- It is idiopathic sudden onset lower motor neuron facial palsy.
- It is mostly unilateral.
- There is edema in the labyrinthine segment of the facial nerve canal of unknown cause; this edema leads to compression of nerve.
- Recent studies show some role of Herpes simplex virus (HSV1). (Not proven)
- Clinical features:
  - Forehead muscles are also paralysed in Bell's palsy. This is because it is LMN facial palsy. (Forehead muscles are not paralysed in UMN palsies)
  - Angle of mouth is deviated to the normal side.
  - There is Loss of Nasolabial fold.
  - This patient complains of Hyperacusis. This is due to loss of stapedial reflex.
  - This patient can develop exposure keratitis because of open eye and decreased lacrimation (dry eye).

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TUTORIALS
LOGIN FOR SUCCESS

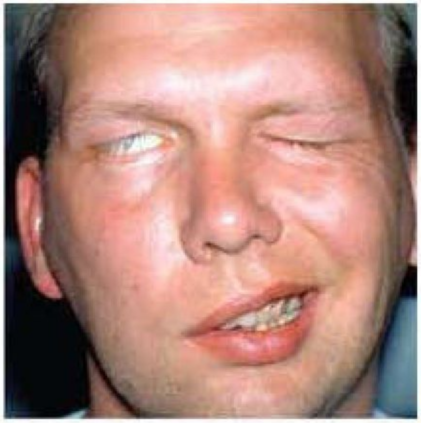


Fig: 1

Treatment-

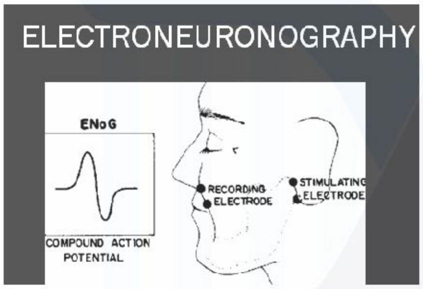
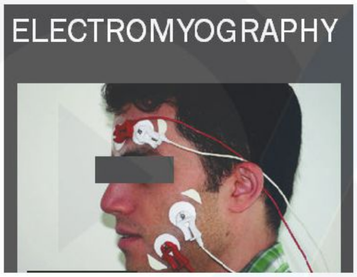
- Drug of choice is Oral steroids for 3 weeks.
- Other treatment
  - Acyclovir (if patient comes within 3 days of onset)
  - Artificial tear drops.
  - Eye pad cover at night.
  - Physiotherapy.
  - The recovery in Bell's palsy is seen in 85% of cases.

MCQ

- If there is no recovery after 3 weeks of steroid therapy, then next management is to do ELECTROPHYSIOLOGICAL NERVE TESTING to check for extent for nerve degeneration.
- If significant degeneration is noted (i.e.,>90% fibres show degeneration), Then treatment is switched to surgery called surgical decompression of facial nerve.
- If it is <90% then continue steroids and Intermittent repeat electrophysiological tests.

TUTORIALS LOGIC FOR SUCCESS

Electrophysiological testing

Electroneuronography	Electromyography
Excite the nerve with current and record the compound action potential in muscle by placing an electrode.	It is about muscle function. So, no nerve stimulation required
 ELECTRONEURONOGRAPHY ENoG RECORDING ELECTRODE STIMULATING ELECTRODE COMPOUND ACTION POTENTIAL	 ELECTROMYOGRAPHY Fig: 2

SYNDROMES RELATED TO FACIAL NERVE

Ramsay hunt syndrome 00:00:13

- Also known as Herpes zoster oticus.
- It is due to reactivation of varicella zoster virus.

Clinical features

- Painful vesicle in external ear.
- 7th nerve- Lower motor neuron facial palsy (ipsilateral)
- +/- 8th nerve involvelemt which leads to vertigo and SNHL.
- +/- 5th nerve involvement which leads to Anaesthesia of face
- Treatment- Acyclovir and steroid therapy.
- Recovery is seen in 50% patients only.

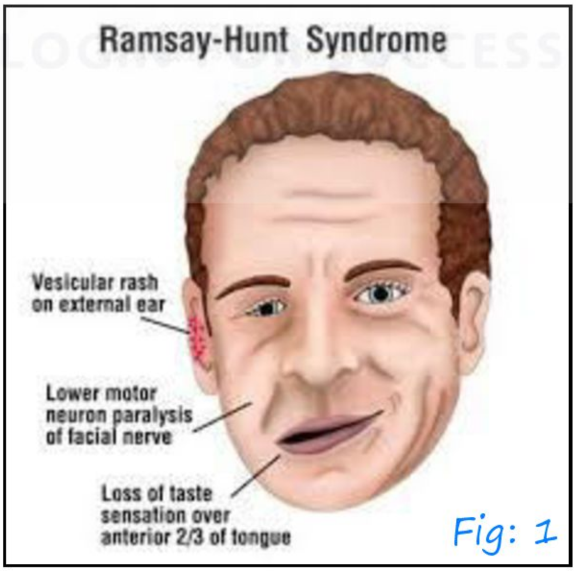

Ramsay-Hunt Syndrome
Vesicular rash on external ear
Lower motor neuron paralysis of facial nerve
Loss of taste sensation over anterior 2/3 of tongue

Fig: 1

Melkersson Rosenthal Syndrome -Triad 00:04:08

- Recurrent facial palsy.

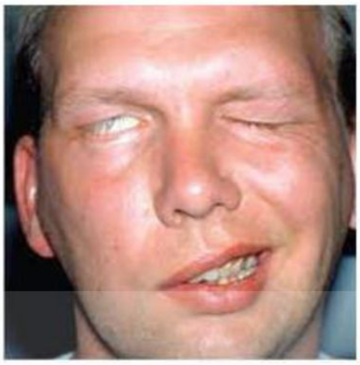


Fig: 2

- Fissured tongue.

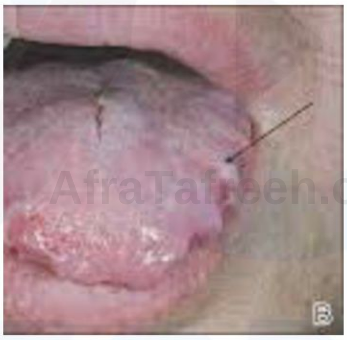


Fig: 3

- Swelling of lips.

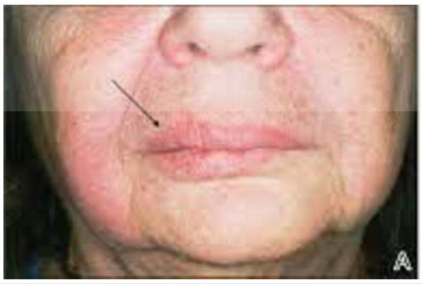


Fig: 4

Moebius Syndrome 00:05:35

- It is a congenital absence of nuclei of 6th and 7th nerves.

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Millard Gubler Syndrome 00:06:12

- It is the absence of nuclei of 6th and 7th nerves and Contralateral hemiplegia.

Heerfordt's Syndrome 00:06:54

- It is seen in Sarcoidosis; it has Triad of
- Parotid swelling.
- Facial palsy.
- Uveitis.

Surgical landmarks for facial nerve

Processus Cochleariformis	1st genu of facial nerve
Lateral SCC bulge	2nd genu of facial nerve.
Horizontal segment of the facial nerve	lies above the oval window and below the lateral SCC area
Tragal cartilaginous pointer (Parotid surgery)	facial nerve lies 1cm deep to it
Tympanomastoid suture	Facial Nerve lies 1cm inferior to it
Posterior belly of Digastric	Facial Nerve bisects the angle between the posterior belly of digastric and ear canal

Iatrogenic injury to facial nerve 00:10:45

- Most common cause is Parotid surgery.
- The 2nd most common cause is mastoid surgery.
- Most common part injured in mastoid surgery is 2nd genu, followed by vertical segment of facial nerve.
- Treatment -Surgical explanation
  - End to end anastomosis.
  - Facial nerve grafting.
  - Source Of graft -
    - Greater auricular nerve.
    - Sural nerve. (Long graft)

Problems associated with facial nerve recovery 00:13:47

Crocodile tears

- It is the Gustatory lacrimation
- When patient eats something, suddenly tears come from eye.
- It is due to the aberrant regeneration of facial nerve fibres after injury
- Fibres for salivary glands connect to fibres meant to supply lacrimal gland
- Treatment- injection Botulinum toxin into lacrimal gland.

Frey's syndrome

- It is a complication of superficial parotidectomy. It is due to injury to the fibres of Auriculotemporal nerve.
- It is the Aberrant Regeneration of fibres which leads to Frey's syndrome.
- The secretomotor fibres for the parotid gland grow aberrantly to supply sweat glands of the skin of pre auricular region
- this leads to Gustatory sweating (sweating in front of pinna on eating or with smell of food).
- Starch Iodine test is done to prove Frey's syndrome.
- Treatment is injection of Botulinum toxin.

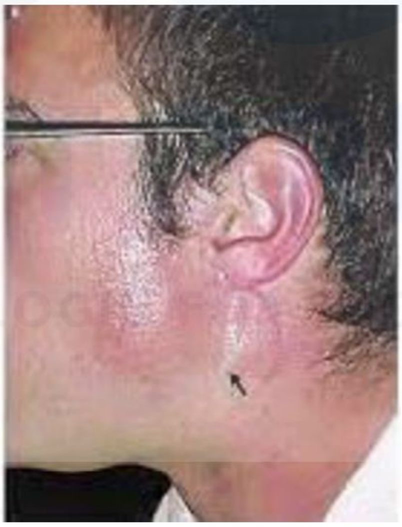

Fig: 5

SURGICAL LANDMARKS AND INJURY

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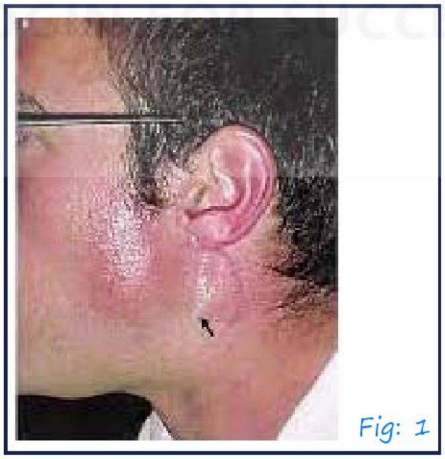

Fig: 1

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EAR DEVICES AND IMPLANTS

First of all, let us classify the hearing loss

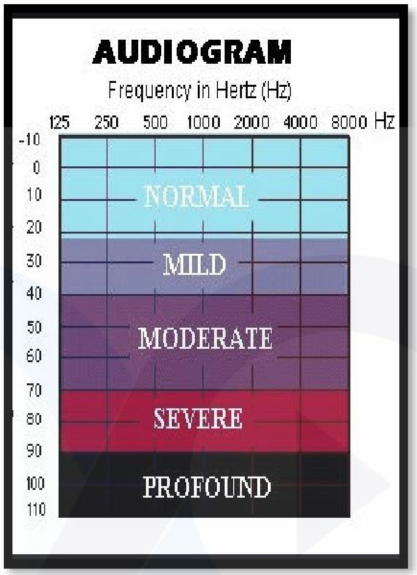
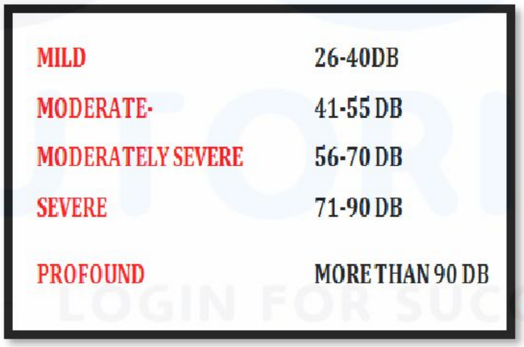


Fig: 1



MILD	26-40DB
MODERATE-	41-55 DB
MODERATELY SEVERE	56-70 DB
SEVERE	71-90 DB
PROFOUND	MORE THAN 90 DB

Fig: 2

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Hearing Aid 00:02:45

- It is a sound Amplifier. It has 4 parts.
  - Microphone (sound to current)
  - Amplifier (amplify current)
  - Receiver (current to sound)
  - Battery

- Types Of hearing aids
  - Pocket model (body worn) – cheaper
  - Behind the ear (BTE)
  - In the Canal (ITC)
  - Completely in the canal (CIC)

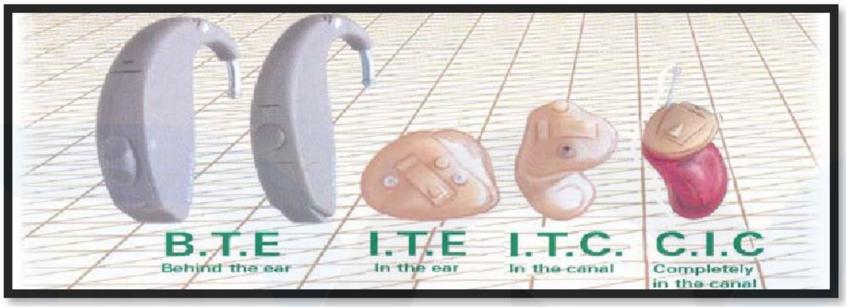

B.T.E
Behind the ear
I.T.E
In the ear
I.T.C.
In the canal
C.I.C
Completely in the canal

Fig: 3

Classification of hearing loss

Mild	26 to 40Db
Moderate	41 to 55dB
Moderately severe	56 to 70dB
Severe	71 to 90dB
Profound	more than 90dB

- Hearing aid is not of much use in profound hearing loss.
- For them we have cochlear implant surgery

Cochlear Implant 00:07:54

- Cochlear Implant does direct electrical stimulation of cochlear nerve endings (8th nerve).
- Prerequisite of CI surgery- is normal 8th nerve. So, MRI is done before Surgery to look for normal 8th nerve.
- This surgery can be done in cochlear dysplasia. Eg- MONDINI'S DYSPLASIA (1½ turn cochlea).
- Indication
  - Bilateral profound SNHL (>90dB) with No improvement seen after 6months of hearing aid use
- Candidates of cochlear Implant are of 2 types
  - Pre lingual deaf- deaf since birth, these are the majority of patients for surgery.
  - Post lingual deaf- acquired after development of speech, they show better results.
- Ideal age of surgery in a child deaf since birth (PRELINGUAL DEAF CHILD) is 1 year
- PROTOCOL
  - If a child is deaf since birth, diagnosis and hearing aid usage should be done by 6 months of age.
  - If no improvement then cochlear implant surgery should be done at 1 year of age.

COCHLEAR IMPLANTS has two components-

- External component (behind the pinna)

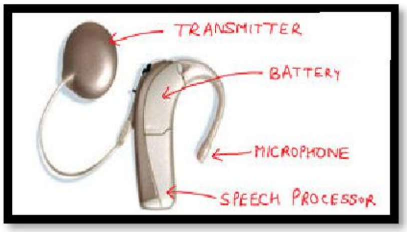


Fig: 4

  - Microphone.
  - Transmitter (circular part which transmit current to internal component)
  - Speech processor.
  - Battery.

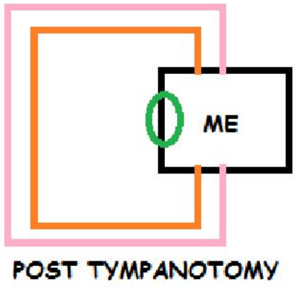
- Internal component- only one part
  - Electrode or receiver stimulator.

Cochlear Implant is of 2 types

- Single channel- one Electrode, one channel to stimulate cochlea
- Multi-channel- 22 Electrode, they give better results.

Cochlear implant surgery has 2 approaches

- Transcanal approach- it is also called VERIA TECHNIQUE.
- Transmastoid approach- this is more popular.


ME
POST TYMPANOTOMY

(Surgical Landmark – Facial Recess) Fig: 5

Steps of Trans-mastoid approach

- Postaural incision
- Cortical mastoidectomy
- Posterior tympanotomy - surgical landmark is facial recess.
- Insertion of Electrode into scala tympani of cochlea through round window.

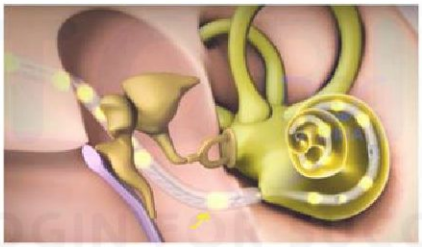


Fig: 6

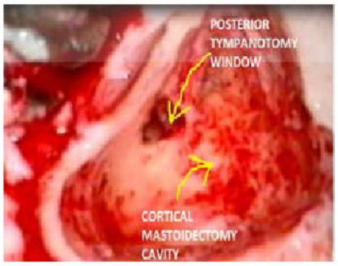

POSTERIOR TYMPANOTOMY WINDOW
CORTICAL MASTOIDECTOMY CAVITY

Fig: 7

- This surgery should be followed by speech therapy training.

Auditory Brainstem Implant 00:34:50

Indication-

- Neurofibroma type 2- bilateral vestibular schwannoma (bilateral 8th nerve diseased)

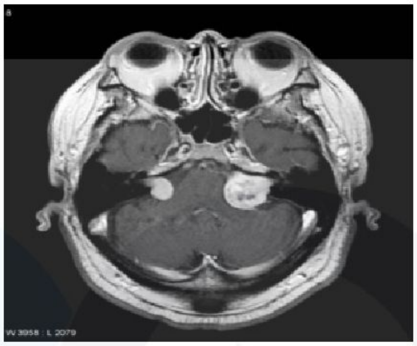


Fig: 8

- Congenital aplasia of 8th nerve.
- Cochlear aplasia (MICHEL'S APLASIA)

Fig: 9

- ABI Electrode is placed in Lateral recess of 4th ventricular.
- ABI electrode stimulates cochlear nucleus. ‘

Bone Anchored Hearing Aid 00:40:12

- It is a specialized surgery in which titanium screw is fixed to the skull bone and then an external sound processor is attached to the screw through an attachment called abutment.

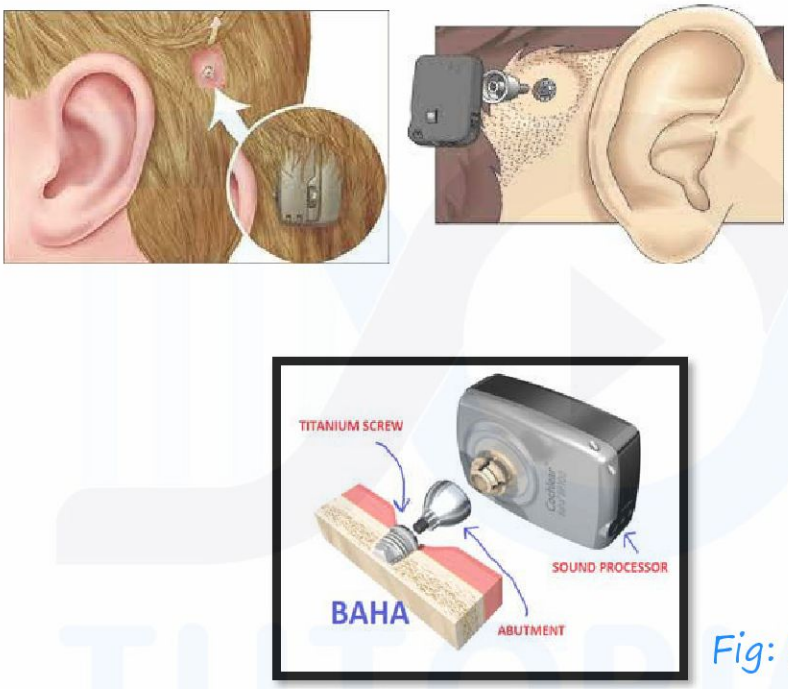

TITANIUM SCREW
Cochlear
SOUND PROCESSOR
BAHA
ABUTMENT

Fig: 10

- BAHA stimulates cochlea directly through BC.

Indications of BAHA

- ANOTIA With Hearing Loss
- EAC ATRESIA With Hearing Loss
- EAC STENOSIS.
- CHRONIC DISCHARGE IN EAR (WET EAR).

- UNILATERAL SEVERE SNHL. It Works on The Principle of CROS (Contralateral Routing Of Signal)

Vibrant Sound Bridge 00:47:00

- Alternate to conventional hearing aid
- It has floating mass transducer (FMT).
- It is clipped to a long process of incus.

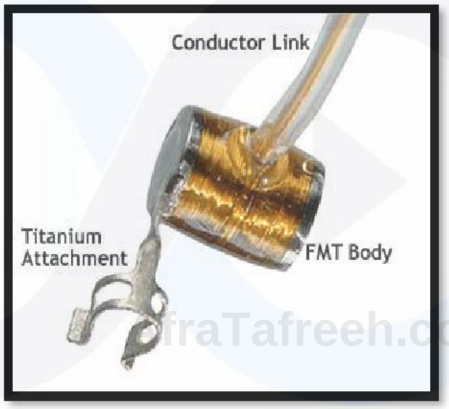

Conductor Link
Titanium Attachment
FMT Body

Fig: 11

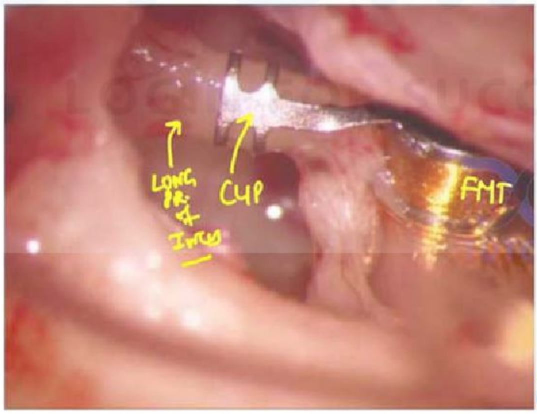

LONG PR. of Incus
CUP
FMT

Fig: 12